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MONTHLY WEATHER REVIEW

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OXYGEN DEFICIENCY IN ANTARCTIC AIR

By ERNEST E. LOCKHART AND ARNOLD COURT

[U. S. Antarctic Service, 1939–1941]

Surprising deficiency in oxygen content of the Antarctic atmosphere, too great to be attributable to instrumental technic, was found in the course of a series of measurements made at Little America III (lat. 78°28′ S., long. 163°30′ W.) during 1940 and 1941.

Oxygen-percentage composition of dry air was found to vary between the wide limits of 20.50 volume percent in summer and 20.80 volume percent in winter, thus indicating a possible seasonal change in the deficiency. "Normal" middle latitude value is 20.95 volume percent.

All of the 25 summertime (December and January) analyses presented here gave values between 20.48 and 20.64 volume percent for oxygen, with an average of 20.556.

Of the 12 wintertime (July and August) determinations, 8 fell between 20.69 and 20.76 volume percent, averaging 20.726. Four others, on July 22, fell entirely outside this range, being between 20.48 and 20.54, with an average value of 20.505.

Since this large variation in the wintertime readings is wholly outside the limits of instrumental error (as discussed later), it seems evident that they represent two radically different types of air. Further light may be thrown on this question, and indeed on the entire subject, by later study of the surface weather records and the upper-air observations.

HISTORY

For 30 years the accepted value for the oxygen concentration in the air of temperate latitudes, where most determinations have been made, has been 20.95 volume percent (1), but "the second decimal is not certain," as Paneth points out (2).

In a more recent paper Carpenter (3), after further work in extension of Benedict's classic determinations of 1909–11, concludes that the entire atmosphere up to the tropopause is constant in composition regardless of meteorological effects, and is but slightly affected by large-scale industrial contaminations.

However, Shepherd (4) has found, in experiments now in progress, confirmation of earlier work by Morley (5) that the oxygen content of polar continental air ("cold waves") is slightly lower than normal. So far as is known, the determinations presented here are the first to be made on the Antarctic Continent itself. However, 10 samples of air obtained by the Charcot expedition of 1908–10 in the Bellingshausen Sea and on the Palmer Land coast, analyzed by Müntz and Lainé (6), showed no oxygen deficiency:

The average of all these results is 20.957. They vary between a minimum of 20.91 and a maximum of 21.00 (volume percent). They are thus comparable to those which Regnault obtained at Paris, where the mean was 20.960, with a minimum of 20.913 and a maximum of 20.990. We must conclude therefore that the air of Antarctic regions contains a proportion of oxygen comparable to that which exists in the climate of France.

Analyses were made in a Regnault eudiometer, modified by Schloesing, of samples collected in the field in glass flasks which were sealed over a gas flame. Carbon dioxide was first removed from the air, and then to the purified air was added a convenient quantity of pure hydrogen and the oxygen computed "by taking one-third of the volume consumed by the combustion."

Four of the samples were obtained in winter quarters on Peterman (Lund) Island (Port Circumcision, 65°11′ S., 64°15′ W.) on the west coast of the Palmer Peninsula, the rest at sea during the cruises of the *Pourquoi Pas.* No correlation between latitude or season can be found in the figures, which agree within the limits of the method used.

However, in the carbon dioxide content, an average of 0.01997 volume percent was obtained (neglecting one poor sample) and the smallest results, 0.01447 and 0.01702, were obtained at the highest latitudes, 69°30′ and 70°05′ S.

It appears from these figures, in a most striking way that the quantity of carbon dioxide which exists in the air of southern regions is quite noticeably less than that which exists in Europe. We have in effect a mean of 0.0205, while determinations of Müntz and Aubin made in the Northern Hemisphere, in very distant stations, gave them a figure of 0.0282. Their former studies, made at Cape Horn in latitude 55°31′, had already given them a mean of 0.0256, quite clearly inferior to that of the Northern Hemisphere. (7).

However, the oxygen analyses of the same Cape Horn air samples, obtained during an astronomical expedition there in 1885, show rather large variations and a general oxygen deficiency. Due to the current state of air analyses, they concluded that their figures showed substantial agreement with determinations elsewhere. (10).

No deficiencies have been noted in high northern latitudes. In 1886 three of the foremost gas analyst of the day made determinations of air at Cleveland, Para, Bonn, Dresden and Tromso, and found that "the oxygen content (of the atmosphere) in the neighborhood of the poles was somewhat higher than in the neighborhood of the Equator," (9) an extrapolation doubly unjustifiable in that its extension northward is not valid and the Southern Hemisphere cannot be considered identical with the Northern Hemisphere.

Krogh, one of the leading analysts of this century, found average or higher than average oxygen content around Greenland in a first series of determinations, average or slightly lower values in a second series (10), and later (11) considers the air to be substantially uniform.

In recent years much work has been done in analyses of air from high levels, the general conclusion to date being that convection maintains a uniform composition

at least as high as the tropopause, above which the oxygen content decreases rapidly, dropping to less than 20.00 percent a few kilometers above it.

Most of these studies have been primarily concerned with ozone, but Regener says (12):

> The height of the ozone layer in the stratosphere should also be lower in polar regions than in equatorial regions, first, because the oxygen content in polar regions decreases with height more rapidly than in equatorial regions and secondly—which is perhaps of even greater effect—because the greater stability of the atmosphere in polar regions tends to increase the diffusion of the heavy ozone downwards.

Concerning the possible effects of the vertical structure of the atmosphere on the oxygen concentration, it may be pointed out that the tropopause at Little America III was found in the summer at 9 to 10 kilometers but tended to disappear entirely in the winter, a continuous lapse rate being observed to −80° C. at 12 km., the instrumental limit. Surface pressures also are an inch or more (30 to 40 mbs.) lower than the world average.

The physical and biological nature of the Antarctic may have some bearing on the results reported here. Oxygen is constantly being removed from the atmosphere, H. Spencer-Jones points out (13), by the weathering of the ferrous oxide of igneous rocks into ferric oxide in sedimentary rocks. "The amount of oxygen withdrawn thus * * * is very considerable," and replenishment is accomplished through the biologic cycle, in which plants liberate oxygen during photosynthesis and processes of decay absorb it. Although "whenever organic matter is buried there is a net gain of oxygen to the atmosphere, it seems probable that * * * if the coal, oil and other organic deposits could be unburied and completely burned, the whole of the oxygen in the atmosphere would be used up."

The Antarctic Continent, while almost devoid of vegetation, has a relative abundance of igneous rocks protruding through its ice cap and subject to intense weathering. Vast unknown areas may have even more mountains than those already explored; of the hundred thousand square miles of hitherto unseen territory explored by the U. S. Antarctic Expedition, more than half was mountainous.

However, most of the rock weathering is mechanical rather than chemical. Although summertime air temperatures lie just below the freezing point, and bare rocks themselves may be actually warm, Wade and Warner (14) estimate that only 10 to 15 percent more rock is uncovered to the air in summer than in winter, when temperatures far below zero prevail.

Discussing "The Origin of Atmospheric Oxygen," Nichols (15) says oxygen may have been an original constituent of the atmosphere, or may be formed by impact of white-hot planetesimals with water vapor, or released by green plants in photosynthesis, or emitted by volcanic vents. Six other possible sources are offered: Decomposition of water vapor by meteoric material (currently as opposed to in geologic times), or by high upper stratosphere temperatures, or by penetrating radiation; decomposition of stony meteorites which contain oxides; formation of ammonia by lightning or meteors; and formation of hydrochloric acid by free chlorine emitted volcanically. He concludes "The net result of all these reactions on the quantity of oxygen in the atmosphere cannot be evaluated at present."

How these various factors affect the oxygen content of the Antarctic atmosphere, this paper does not venture to say. It is merely to present (table 1) the results of an investigation conducted incidentally to studies in physiology, on the one hand, and in general climatic and aerologic conditions, on the other.

EXPERIMENTAL

Analyses were made during July, August and December of 1940 and January of 1941 at Little America III, the West Base of the U. S. Antarctic Service. This base was on the so-called Ross Ice Shelf some three miles south of the edge at which this thick ice sheet terminates as the Ross Ice Barrier, the southern limit of navigation in the Ross Sea.

It was about 1 mile east of the Bay of Whales and about 7 miles northeast of Little America I and II, the base of the Byrd Antarctic Expeditions of 1928–30 and 1933–35. Ice and snow surround the camp for hundreds of miles in all directions except for the sea to the north. Thus, most of the air analyzed had been in transit over a pure snow surface for some time before collection.

Samples were taken only after wind direction had been generally constant for at least 6 hours and were always obtained to windward of camp to avoid contamination from camp smoke and gases. The air was collected over mercury in a 60 ccm. gas-sampling bottle and was allowed to come to room temperature (since outside temperatures were always below freezing) before analysis in a portable Haldane apparatus (13), which is described here briefly.

It consists essentially of five parts: (1), a calibrated measuring burette of 10 ccm. capacity; (2), an absorption pipette filled with potassium hydroxide for carbon dioxide; (3), an absorption pipette filled with alkaline potassium pyrogallate for oxygen; (4), an uncalibrated tube, similar to the measuring burette, called the thermobarometer, for automatic compensation of slight changes in temperature during analysis; and (5), a leveling bulb filled with mercury by which gas samples can be drawn into the apparatus, measured at atmospheric pressure, forced successively into the carbon dioxide absorption pipette, into the measuring burette for determination of the new volume, then into the oxygen absorption pipette and finally into the measuring burette for final volume determination.

Both measuring burette and thermobarometer are contained in a water chamber kept at uniform temperature by stirring. The various parts, joined together by short lengths of heavy-walled rubber tubing, are mounted compactly in a carrying case which becomes a support during use. Communication from the measuring burette to the sample flask and to the absorption pipettes is regulated by several stopcocks. Small portions of acidified water in the thermobarometer and above the mercury in the measuring burette keep the gas sample saturated with water vapor at all times.

Operation of the apparatus, although simple, requires that particular care be given to details to obtain reliable results. Before introduction of the sample, carbon dioxide and oxygen in the apparatus are eliminated by drawing air into the burette and running it alternately into the two absorption pipettes until no further absorption of gas occurs; at this stage the apparatus contains only nitrogen saturated with water vapor.

After this nitrogen has been washed out of the apparatus with several small portions of the sample to be analyzed, a 10 ccm. portion is drawn in and allowed to become saturated. The initial volume is measured, the carbon dioxide removed and the new volume measured; then the oxygen is absorbed and the final volume determined. The two decreases in volume correspond respectively to the carbon dioxide and oxygen contents of the original

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dry-air sample. Simple calculations give percentage compositions of the dry constituents.

Thus the figures obtained are absolute values comparable to absolute values determined by other methods in other areas. They represent, however, percentages of only the dry constituents of the original sample. Due to the method of the apparatus, no determination could be made of the amount of water vapor present; no psychrometric observations were made because of the low temperatures prevalent.

As further clarification of the data the following statement from Peters and Van Slyke (16) may be quoted:

> In the analysis of moist air by the Haldane method each volume measurement, before or after the absorption of any gas, is made at the same partial pressure of the dry gases. This pressure is $B-W$ (barometric pressure less vapor tension of water). The effect of the vapor tension W is therefore merely to lower the pressure of all volume readings by a constant amount and thereby to increase all volume readings by a constant proportion over what they would be for the dry gases * * *. The results of a gas analysis are therefore independent of temperature, barometric pressure and wet or dry state of the gas, so long as these factors are constant.

TABLE 1.—*Analysis of Antarctic air*

Date	CO_2 volume	O_2 volume	Residual (N_2, A, etc.)	Wind movement: At collection: Direction	Wind movement: At collection: M. p. h.	Wind movement: Past 12 hours	Temperature	Barometer in past 6 hours
	Pct.	*Pct.*					°F.	
Winter-1940:								
July 13	0.06	20.75	79.19	E.	7	S.-E.	−47	Very steady.
	.07	20.76	79.17					
22	.06	20.54	79.40	E.	10	E.	−28	Rising fast.
	.07	20.51	79.42					
22*	.07	20.48	79.45	E.	10	E.	−27	Rising fast.
	.09	20.49	79.42					
29	.03	20.73	79.24	E.	13	E.-SE.-E.	−14	Very steady.
	.06	20.73	79.21					
29*	.03	20.72	79.25	E.	13	E.-SE.-E.	−14	Very steady.
	.04	20.73	79.23					
Aug. 6	.04	20.70	79.26	S.	11	S.-SW.-S.	−40	Strong rise.
	.03	20.69	79.28					
Summer-1940:								
Dec. 31	.09	20.50	79.41	W.	4	W.-NW.-W.	+28	Rising slowly.
	.09	20.50	79.41					
31*	.08	20.49	79.43	NW.	6	W.-NW.-W.	+29	Rising slow.
	.06	20.50	79.42					
1941:								
Jan. 2	.17	20.53	79.30	NE.	16	E.-NE.-E.	+32	Steady.
	.15	20.49	79.36					
4	.11	20.59	79.30	SE.	9	E.-SE.-S.	+24	Falling slowly.
	.09	20.58	79.33					
5	.04	20.54	79.42	SE.	10	SE.	+20	Steady.
	.02	20.53	79.45					
	.06	20.48	79.46					
5*	.06	20.52	79.42	SE.	9	SE.	+18	Steady.
	.07	20.53	79.40					
6	.16	20.55	79.29	SW.	6	SW.-S.-SW.	+22	Strong fall.
	.14	20.57	79.29					
Jan. 12	.05	20.58	79.37	SW.	14	SW.-S.-SW.	+25	End of rise.
	.07	20.59	79.38					
15	.03	20.63	79.34	SE.	14	E.-SE.	+16	Falling.
	.06	20.63	79.31					
16	.09	20.56	79.34	SE.	12	SE.	+18	End of fall.
	.09	20.56	79.34					
18	.06	20.60	79.34	E.	7	S-SE.-E.	+12	Steady.
	.06	20.60	79.34					
18*	.07	20.60	79.33	SE.	9	S.-E.-SE.	+12	Steady.
	.06	20.64	79.30					

*Different samples on the same day.

DISCUSSION

In view of the fact that the results obtained in this study are so divergent from those presented by Benedict (1) and Carpenter (3), which are to be considered as standards for atmosphere in temperate climates below the tropopause, some discussion of any possible errors in the determinations is necessary.

The apparatus itself is one that has been in constant use over a period of years in the Fatigue Laboratory at Harvard University and also on several field trips throughout the country. Results obtained with it have always been above criticism. Unfortunately, no check determinations on "standard" middle latitude air were made with the apparatus. The air analysis program was not planned until the expedition was in the Antarctic, so no samples were taken along for comparison. After the results had been obtained it was planned to make a series of readings whenever the ship was moored during the northward voyage home, but before these could be begun the Haldane apparatus was rendered inoperative during a severe storm.

The reagents used were of the highest quality and absorbents prepared from them exactly according to the procedures recommended by Peters and van Slyke. Any decrease in the efficiency of the reagents, especially the potassium pyrogallate, was readily noted as a sluggishness in absorption and a failure to give constant results within a prescribed time. Whenever such an occasion arose, the old reagents were replaced by fresh ones.

Leaks in the apparatus, which occurred occasionally, were easily detected because of inconstancy of readings and failure to obtain check results on a given sample. These were immediately eliminated by removal, cleaning and regreasing of all stopcocks. The apparatus was then tested according to the prescribed procedure.

Contamination of the sample during transfer from the sample bottle to the measuring burette is impossible. After the sample is in the apparatus, the possible effect of changes in external conditions is eliminated. In short, unless the apparatus is clean, all capillary tubing and stopcocks free for the passage of gas, the reagents in good condition and the proper routine followed, check results are impossible.

All of the determinations were done in duplicate at least, and separate analyses of the same sample were taken as data for this report only when they agreed within the experimental limits of error of the apparatus, which are 0.03 percent for carbon dioxide and 0.04 percent for oxygen. Consequently, the apparent deficiency of oxygen in the Antarctic atmosphere is considered to be real.

SUMMARY

Analyses of the lower atmosphere of the Antarctic were made using the Haldane portable apparatus. A variable deficiency in the oxygen content of the air, too great to be attributable to instrumental error, was found. The values for oxygen range from 20.76 to 20.48 volume percent. Since all possible sources of error were eliminated, the deficiency is considered to be real.

ACKNOWLEDGMENTS

To Dr. Martin Shepherd of the National Bureau of Standards is due the original suggestion that the analyses be made. He requested that 10 special air-sample flasks be filled in the Antarctic and returned to him. These flasks were taken along and duly filled at the expedition's East Base, in Palmer Land, 800 miles south of Cape Horn, but were abandoned there together with all other equipment when ice conditions forced evacuation of all personnel at that base by airplane. The analyses here given were made at West Base, 1,400 miles away, independently of the original program.

Grateful acknowledgment is made to Dr. D. B. Dill of the Fatigue Laboratory at Harvard University for the

loan of equipment and to Merck and Company and to J. T. Baker Co. for the donation of essential chemicals.

Publication of this report has been approved by the U. S. Antarctic Service.

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METEOROLOGICAL AND CLIMATOLOGICAL DATA FOR MAY 1942

[Climate and Crop Weather Division, J. B. KINCER, in charge]

AEROLOGICAL OBSERVATIONS

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during May 1942*

Altitude (meters) m. s. l.	Albuquerque, N. Mex. (1,620 m.)				Atlanta, Ga. (300 m.)				Bismarck, N. Dak (505 m.)				Boise, Idaho (864 m.)				Brownsville, Tex. (6 m.)				Buffalo, N. Y. (221 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	834	19.3	18	31	982	19.1	75	31	955	10.1	74	31	914	11.8	64	30	1012	24.4	85	31	990	13.1	82
500					31	960	20.1	64									30	957	21.8	89	31	958	13.8	72
1,000					31	906	17.1	64	31	900	8.6	70	31	899	12.7	60	30	904	20.9	65	31	902	11.8	71
1,500					31	854	13.3	68	31	847	5.7	71	31	847	10.3	55	30	853	19.8	53	31	850	9.0	75
2,000	31	798	18.8	17	31	804	9.9	70	31	796	3.3	72	31	797	6.4	56	30	804	17.1	47	31	800	6.5	72
2,500	31	752	15.0	17	31	757	7.0	65	31	748	0.6	70	31	749	2.4	60	30	758	14.4	41	31	752	4.0	68
3,000	31	709	10.6	18	31	712	3.9	60	31	703	−1.9	67	31	704	−1.2	63	30	714	11.4	41	31	707	1.5	65
4,000	31	628	2.1	19	30	630	−0.7	47	30	619	−7.5	58	31	620	−8.5	67	30	633	5.3	37	31	624	−4.1	61
5,000	31	554	−6.6	21	30	555	−7.2	42	30	544	−14.1	53	31	544	−15.3	63	29	560	−1.7	38	31	549	−10.4	57
6,000	31	486	−14.5	23	29	487	−14.3	40	30	476	−21.3	52	30	476	−22.5	62	29	493	−8.5	37	31	482	−16.8	53
7,000	31	425	−21.6	23	29	426	−21.2	39	30	414	−28.8	50	29	414	−29.8	62	28	433	−15.3	35	31	421	−23.9	51
8,000	31	370	−28.8	22	29	372	−28.2	38	30	359	−36.9	49	29	359	−37.1	59	28	378	−22.1	35	31	366	−31.2	50
9,000	30	322	−36.3		29	322	−35.5	38	29	310	−44.7		29	310	−43.8		27	329	−29.3	35	31	317	−38.8	49
10,000	30	278	−43.7		28	279	−42.9		29	266	−51.3		29	267	−49.0		27	286	−36.8	35	29	274	−46.2	
11,000	29	239	−50.6		28	240	−49.8		29	228	−54.4		29	229	−52.5		27	247	−44.5		29	235	−52.2	
12,000	29	204	−56.2		28	206	−55.8		27	195	−55.3		29	196	−53.9		25	212	−52.1		27	201	−57.7	
13,000	29	174	−59.4		28	175	−60.6		27	166	−55.0		28	167	−54.0		24	182	−58.8		27	171	−60.3	
14,000	28	148	−61.0		28	149	−61.7		25	142	−54.4		26	143	−54.0		24	154	−64.9		27	145	−60.7	
15,000	27	126	−61.7		28	127	−61.9		22	122	−55.1		24	122	−54.6		20	131	−70.0		23	124	−59.2	
16,000	25	108	−63.0		28	108	−62.5		18	104	−56.0		22	105	−55.2		20	111	−73.3		23	106	−59.2	
17,000	20	91	−62.6		28	92	−63.0		13	89	−55.7		16	89	−55.9		15	93	−75.8		18	90	−58.5	
18,000	11	77	−61.8		22	78	−62.2		9	76	−54.9		9	76	−56.1		12	78	−74.6		11	76	−58.1	
19,000	7	66	−60.3		14	66	−60.7										9	66	−71.4					
20,000					5	56	−59.1										5	56	−67.9					

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during May 1942*—Continued

Stations and elevations in meters above sea level

Altitude (meters) m. s. l.	Caribou, Maine (191 m.)				Charleston, S. C. (14 m.)				Denver, Colo. (1,616 m.)				Detroit, Mich. (194 m.)				El Paso, Tex. (1,193 m.)				Ely, Nev. (1,908 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	994	10.3	79	31	1016	19.4	91	31	835	11.9	58	31	992	13.0	81	31	878	23.6	16	31	806	8.5	49
500	31	958	10.9	75	31	961	19.3	73					31	956	13.9	73								
1,000	31	902	8.9	68	31	906	16.5	67					31	901	12.0	68								
1,500	31	849	6.3	68	31	854	13.2	67					31	849	9.3	69	31	848	24.4	15				
2,000	31	798	3.2	68	31	805	10.0	67	31	798	11.8	52	31	799	6.8	63	31	800	20.6	15	31	798	9.4	48
2,500	31	750	.5	65	31	757	7.2	63	31	751	8.7	52	31	751	4.0	58	31	755	16.4	15	31	751	6.7	47
3,000	31	704	−1.9	64	31	713	4.8	57	31	706	5.2	54	31	706	1.7	52	31	711	12.1	15	31	706	2.4	49
4,000	31	621	−7.6	60	30	630	− .6	47	31	624	−2.1	58	31	623	−4.5	44	31	630	3.9	16	30	623	−5.8	53
5,000	31	545	−13.4	52	30	555	−6.8	43	31	549	−9.9	57	31	548	−10.9	40	31	556	−4.3	17	30	548	−13.5	56
6,000	31	477	−19.9	49	29	487	−13.2	40	31	482	−17.7	55	31	481	−17.2	40	31	489	−11.8	17	29	479	−20.7	56
7,000	31	416	−27.0	48	29	427	−20.1	40	31	421	−25.4	53	31	420	−24.2	38	31	428	−19.1	17	26	418	−27.0	55
8,000	31	361	−34.0	46	29	372	−27.2	38	31	366	−33.0	52	30	365	−31.4	38	31	374	−26.2	17	25	363	−34.0	52
9,000	31	312	−41.1		29	323	−34.5	35	31	316	−40.5		30	316	−39.1	38	31	324	−33.6	17	25	314	−41.3	
10,000	29	269	−47.6		29	280	−41.9		31	272	−47.3		30	273	−46.6		31	281	−40.8		25	271	−47.7	
11,000	29	231	−52.9		28	241	−49.2		31	234	−53.3		29	234	−52.7		31	242	−48.3		22	232	−53.4	
12,000	28	198	−56.1		28	206	−56.3		30	200	−57.6		28	200	−57.7		31	207	−55.0		20	199	−57.2	
13,000	26	169	−58.3		26	176	−60.5		28	170	−59.1		27	171	−59.7		30	177	−60.0		19	170	−59.0	
14,000	21	144	−57.7		24	150	−62.1		25	145	−58.9		24	145	−59.8		30	150	−62.9		17	144	−57.9	
15,000	18	123	−57.0		21	127	−62.9		25	123	−58.7		24	124	−59.4		28	128	−64.3		14	123	−58.1	
16,000	13	105	−56.9		18	108	−63.5		22	105	−59.2		22	106	−58.8		23	109	−65.6		13	105	−59.2	
17,000	8	89	−57.2		16	91	−63.8		20	90	−58.6		21	90	−59.2		15	92	−66.1		8	90	−59.2	
18,000					13	77	−63.3		15	77	−58.8		15	77	−59.2		7	78	−67.3					
19,000					9	66	−62.3						7	65	−59.3									

Stations with elevations in meters above sea level

Altitude (meters) m. s. l.	Great Falls, Mont. (1,128 m.)				Huntington, W. Va. (172 m.)				Joliet, Ill. (178 m.)				Lake Charles, La. (6 m.)				Lakehurst, N. J. (1) (39 m.)				Medford, Oreg. (401 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	885	10.1	64	31	996	15.8	84	30	994	12.9	81	31	1,014	21.7	89	31	1,013	15.3	78	30	968	13.7	69
500					31	959	17.2	71	30	957	14.2	74	31	958	20.9	77	31	960	15.9	63	30	956	13.4	68
1,000					31	904	14.5	68	30	901	11.6	73	31	904	18.7	69	31	905	13.8	60	30	901	10.4	70
1,500	31	846	8.7	62	31	852	11.7	69	30	849	9.0	73	31	853	16.0	61	31	853	11.0	56	30	848	6.6	78
2,000	31	796	5.3	61	31	802	8.5	72	30	799	6.5	69	31	804	13.6	55	31	803	8.5	52	30	798	2.9	86
2,500	31	748	1.6	63	31	754	5.4	75	30	751	4.4	62	31	758	11.4	50	31	755	5.4	51	30	750	−0.4	87
3,000	31	703	−2.1	69	31	710	2.6	71	30	706	1.9	59	31	714	8.7	47	31	710	2.4	50	30	704	−3.5	82
4,000	29	619	−9.5	77	30	626	−3.0	61	30	624	−3.7	50	31	631	2.7	41	31	627	−3.2	45	30	620	−9.5	72
5,000	29	543	−16.1	76	29	551	−9.1	56	30	549	−10.4	47	31	557	−3.5	37	31	551	−9.3	41	30	544	−15.5	64
6,000	29	475	−23.1	73	29	484	−15.9	51	29	481	−17.3	46	31	490	−10.7	35	31	484	−15.9	45	30	476	−21.9	60
7,000	29	413	−30.8	70	29	423	−23.3	50	27	420	−24.6	46	30	430	−17.7	34	31	423	−23.1	47	30	414	−28.8	60
8,000	28	358	−38.4	69	29	368	−30.5	48	26	364	−32.1	45	30	376	−25.1	34	31	368	−30.4	51	30	359	−35.7	59
9,000	28	309	−45.8		29	319	−37.9	47	25	315	−39.5		30	326	−32.4	34	31	319	−37.7	53	30	310	−42.2	
10,000	28	265	−51.8		28	275	−45.2		24	272	−46.2		30	283	−40.1		30	276	−45.1		30	267	−48.0	
11,000	28	227	−54.5		28	236	−51.9		24	234	−51.6		30	244	−47.7		30	237	−52.3		29	230	−52.4	
12,000	28	194	−54.2		27	202	−57.6		24	200	−55.5		30	209	−55.1		30	202	−58.3		29	196	−54.6	
13,000	26	166	−53.4		25	172	−61.1		24	170	−56.9		30	178	−60.9		30	172	−61.7		28	168	−55.0	
14,000	25	142	−51.5		24	146	−61.1		24	146	−57.6		28	151	−64.5		30	147	−62.5		28	143	−54.7	
15,000	21	121	−51.8		23	124	−60.6		23	124	−58.0		24	128	−66.7		29	126	−61.6		28	122	−54.8	
16,000	19	104	−52.3		20	106	−60.5		23	106	−58.2		23	109	−68.9		29	107	−61.4		25	105	−54.7	
17,000	16	88	−52.5		17	90	−59.7		20	90	−58.6		22	92	−70.1		23	91	−60.8		21	89	−54.5	
18,000	6	76	−52.7		11	76	−58.6		16	77	−57.8		17	78	−70.1		13	77	−60.0		13	76	−54.5	
19,000									10	65	−56.6		10	67	−67.6		5	65	−58.9		10	65	−54.4	
20,000									5	56	−54.8													

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during May 1942*—Continued

Stations and elevations in meters above sea level

Altitude (meters) m. s. l.	Miami, Fla. (4 m.)				Nashville, Tenn. (180 m.)				Norfolk, Va.(1) (10 m.)				Oakland, Calif. (2 m.)				Oklahoma City, Okla. (391 m.)				Omaha, Nebr. (301 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	1,016	22.9	82	31	995	18.7	71	27	1,018	20.0	78	31	1,016	14.5	73	29	998	18.6	70	31	978	15.1	77
500	31	960	21.3	82	31	958	18.8	66	27	960	18.4	66	31	958	12.0	73	29	955	19.0	68	31	955	15.6	69
1,000	31	906	18.1	79	31	904	16.0	65	27	906	15.4	64	31	902	10.8	61	29	902	17.1	67	31	900	13.1	67
1,500	31	855	15.3	77	31	852	12.7	67	27	854	12.6	59	31	850	8.8	54	29	850	14.7	63	31	848	10.3	69
2,000	31	805	12.4	73	31	803	9.7	68	27	804	9.7	58	31	799	6.2	51	29	801	12.9	54	31	798	7.8	65
2,500	31	759	9.7	64	31	756	7.2	64	27	757	6.6	51	31	752	3.9	46	29	754	10.7	46	31	751	5.4	58
3,000	31	714	7.1	54	31	711	4.8	58	27	712	3.5	48	31	707	1.5	43	29	710	7.4	43	31	706	3.0	54
4,000	31	632	2.3	43	31	628	−0.5	50	27	629	−2.9	45	31	624	−3.9	42	29	628	0.6	43	31	623	−3.5	51
5,000	31	558	−3.5	38	31	554	−6.9	45	26	553	−9.3	41	31	549	−9.9	42	29	554	−6.2	42	31	549	−10.1	45
6,000	31	491	−9.2	34	31	487	−13.7	44	26	485	−15.6	41	31	481	−16.6	41	28	487	−13.0	41	31	481	−17.1	41
7,000	29	431	−15.9	30	31	426	−21.2	43	25	424	−22.9	42	30	421	−23.3	41	28	426	−20.4	40	31	420	−24.6	38
8,000	29	377	−23.1	28	31	371	−28.5	42					28	365	−30.3	40	28	371	−28.0	39	31	365	−32.3	37
9,000	29	327	−30.1	27	31	322	−35.9	42					26	316	−38.0	39	28	322	−35.7	38	31	316	−39.5	38
10,000	29	284	−37.6	27	30	278	−43.2						24	273	−45.6		28	279	−43.4		31	273	−46.3	
11,000	29	245	−45.1		29	239	−49.9						22	234	−52.7		27	240	−50.7		30	234	−51.7	
12,000	29	210	−51.6		29	205	−55.8						22	200	−58.1		24	205	−57.3		29	200	−56.0	
13,000	29	180	−57.4		29	175	−59.8						19	171	−60.7		23	175	−61.5		29	171	−58.0	
14,000	29	153	−61.6		28	149	−61.6						17	145	−60.5		20	149	−61.7		28	146	−59.1	
15,000	27	130	−64.6		27	127	−61.8						15	123	−60.0		20	126	−61.9		23	124	−59.2	
16,000	27	111	−66.4		26	108	−62.3						13	105	−59.8		18	108	−62.8		19	106	−59.2	
17,000	25	94	−67.4		23	92	−62.8						12	89	−59.8		18	92	−63.2		9	90	−58.8	
18,000	25	79	−67.1		18	78	−62.6						9	75	−58.7		12	78	−61.9					
19,000	20	67	−65.8		15	66	−61.7										6	66	−59.1					
20,000	13	56	−63.7		7	56	−59.4																	

Stations with elevations in meters above sea level

Altitude (meters) m. s. l.	Pensacola, Fla. (1) (24 m.)				Phoenix, Ariz. (339 m.)				Portland, Maine (20 m.)				St. Louis, Mo. (171 m.)				St. Paul, Minn. (225 m.)				San Antonio, Tex. (175 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	24	1,014	22.0	73	31	969	23.4	30	31	1,015	10.2	87	31	995	17.1	74	31	986	13.1	73	31	994	22.9	79
500	24	960	20.1	62	31	951	27.4	24	31	959	13.1	72	31	957	17.4	64	31	955	12.8	69	31	958	21.2	82
1,000	24	905	17.5	53	31	898	24.7	22	31	904	11.3	69	31	902	14.6	62	31	900	10.1	69	31	904	19.2	79
1,500	24	854	14.2	51	31	848	20.7	22	31	851	8.3	70	31	850	11.5	62	31	847	7.2	70	31	853	17.4	76
2,000	24	804	11.6	45	31	800	16.3	22	31	800	5.4	67	31	800	9.2	58	31	797	4.9	69	31	804	15.3	69
2,500	24	757	9.0	42	31	754	12.1	22	31	752	2.6	64	31	754	6.3	62	31	749	2.7	65	31	758	12.9	61
3,000	24	712	6.5	35	31	710	8.5	22	31	708	−0.2	63	31	709	3.4	61	31	704	0.3	60	31	714	10.7	44
4,000	21	630	0.7	27	31	628	1.8	22	29	624	−5.1	56	31	626	−2.3	53	30	621	−5.7	54	31	632	4.0	40
5,000	21	555	−5.7	27	31	554	−4.7	22	26	549	−11.1	54	31	551	−8.5	49	29	546	−12.3	53	29	558	−2.8	37
6,000	20	488	−12.0	29	31	487	−11.9	22	25	480	−17.7	50	31	484	−15.3	49	29	478	−19.4	52	28	492	−9.8	37
7,000	19	427	−18.8	36	31	427	−19.7	22	24	419	−24.4	49	31	423	−22.5	49	26	417	−26.6	50	26	431	−17.0	37
8,000	17	373	−26.2	36	31	372	−27.5	22	23	364	−31.4	48	31	368	−29.8	48	26	362	−34.4	48	25	377	−24.2	37
9,000	15	324	−33.8		31	323	−35.2	22	20	315	−39.1		31	319	−37.5	48	26	313	−41.8		26	327	−31.6	36
10,000	12	281	−41.2		31	279	−42.8		20	272	−46.0		31	276	−44.9		26	270	−48.4		25	284	−39.2	36
11,000	8	242	−48.8		30	240	−49.8		18	234	−52.1		31	237	−51.7		25	232	−53.0		24	245	−46.8	
12,000	7	208	−56.4		30	206	−55.8		16	200	−56.9		30	203	−57.2		24	198	−54.1		22	210	−54.3	
13,000	5	176	−62.0		29	176	−60.0		16	170	−58.2		29	173	−57.5		22	169	−55.7		22	180	−60.0	
14,000					28	150	−61.5		13	145	−57.7		27	147	−57.7		21	145	−55.7		21	153	−63.8	
15,000					22	127	−62.7		12	123	−56.9		27	125	−58.0		16	124	−55.8		19	130	−66.4	
16,000					21	108	−63.7		10	105	−56.2		25	107	−58.5		12	106	−57.0		18	110	−68.0	
17,000					17	92	−64.4		7	90	−54.7		20	91	−58.7		10	90	−56.6		16	93	−68.5	
18,000					14	78	−63.4		5	77	−54.1		18	77	−58.5		7	77	−56.2		11	78	−67.2	
19,000					6	66	−62.7						13	66	−57.4						8	66	−65.5	
20,000													5	56	−55.7									

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during May 1942*—Continued

Stations with elevations in meters above sea level

Altitude (meters) M. S. L.	San Diego, Calif., (1) (19 m.)				S. S. Marie, Mich. (221 m.)				Seattle, Wash. (1) (27 m.)				Spokane, Wash. (598 m.)				Washington, D. C. (25 m.)				Anchorage, Alaska (42 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	29	1,011	16.0	79	31	989	7.7	82	29	1013	13.8	72	31	943	12.4	69	31	1014	18.8	71	30	1009	13.6	57
500	29	956	14.1	70	31	957	9.4	74	29	958	10.8	69					31	960	17.7	65	30	955	10.6	58
1,000	29	901	14.1	54	31	901	8.5	70	29	902	7.2	71	31	899	10.8	64	31	905	15.3	66	30	900	6.7	61
1,500	29	849	13.7	37	31	848	6.4	67	29	848	3.6	74	31	846	7.4	66	31	853	12.0	69	30	846	2.8	65
2,000	29	800	12.2	29	31	797	3.7	67	29	797	0.3	77	31	796	3.6	71	31	804	9.0	66	30	795	−0.7	68
2,500	29	753	10.0	26	31	749	1.3	65	29	748	−2.6	76	31	748	0.1	74	31	756	5.8	68	30	746	−3.7	68
3,000	29	709	7.7	22	31	704	−1.0	61	29	703	−6.0	72	30	703	−3.3	74	31	711	3.2	65	29	700	−6.6	68
4,000	29	627	2.1	23	31	620	−6.3	53	29	618	−11.8	67	30	618	−10.0	71	31	628	−1.7	53	29	615	−12.3	66
5,000	28	552	−5.1	24	30	546	−12.6	49	28	542	−18.1	62	30	542	−16.6	65	30	553	−8.1	48	27	539	−18.7	63
6,000	27	486	−12.3	25	27	478	−19.2	45	27	473	−25.1	66	27	474	−23.7	63	30	486	−14.6	45	27	471	−25.3	62
7,000	27	425	−20.1	22	26	417	−26.1	43	27	411	−32.2	69	26	412	−31.1	62	29	425	−21.8	44	27	409	−32.5	61
8,000	12	372	−27.9	.....	25	362	−33.1	42	27	356	−39.4	75	25	357	−38.6	60	28	370	−29.1	44	27	354	−40.1	.....
9,000	12	322	−35.7	.....	24	314	−40.4	.....	26	307	−46.4	.....	25	308	−45.6	.....	27	320	−36.5	45	25	306	−47.2	.....
10,000	11	279	−42.7	.....	22	271	−47.4	.....	25	264	−52.2	.....	24	264	−50.5	.....	24	277	−44.3	.....	24	262	−53.3	.....
11,000	11	240	−49.9	.....	19	232	−52.5	.....	22	226	−55.1	.....	22	227	−52.5	.....	20	238	−51.5	.....	23	225	−55.2	.....
12,000	11	205	−56.6	.....	18	199	−54.7	.....	22	193	−55.4	.....	21	194	−52.4	.....	19	204	−58.0	.....	19	192	−53.2	.....
13,000	9	176	−61.2	.....	18	170	−55.1	.....	19	165	−54.8	.....	21	166	−52.2	.....	19	173	−62.1	.....	19	165	−51.6	.....
14,000	9	150	−63.0	.....	16	146	−54.2	.....	17	141	−54.0	.....	17	142	−52.5	.....	19	147	−61.6	.....	19	142	−50.7	.....
15,000	8	128	−63.3	.....	14	125	−54.6	.....	16	121	−54.2	.....	17	122	−53.3	.....	15	125	−60.4	.....	18	122	−51.1	.....
16,000	8	109	−64.0	.....	13	107	−54.9	.....	11	103	−54.1	.....	16	105	−53.7	.....	13	107	−61.0	.....	17	105	−51.1	.....
17,000	5	92	−63.5	.....	11	91	−54.9	.....	7	89	−54.3	.....	12	90	−53.9	.....	9	91	−61.3	.....	11	90	−50.9	.....
18,000	.....	.....	.....	.....	6	78	−54.5	.....	.....	.....	.....	.....	7	77	−53.9	.....	7	78	−60.8	.....	8	77	−50.5	.....
19,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6	66	−49.8	.....

Stations with elevations in meters above sea level

Altitude (meters) m. s. l.	Barrow, Alaska (6 m.)				Fairbanks, Alaska (166 m.)				Juneau, Alaska (40 m.)				Ketchikan, Alaska (26 m.)				McGrath, Alaska (103 m.)				Nome, Alaska (14 m.)				San Juan, P. R. (15 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	1019	−5.8	92	31	993	16.2	40	31	1008	13.9	55	31	1012	11.9	73	30	999	12.6	52	31	1013	3.1	73	30	1014	25.2	86
500	31	957	−7.2	90	31	954	12.9	41	31	956	10.6	58	31	956	9.2	77	30	952	9.2	53	31	954	1.0	76	30	960	22.8	88
1,000	31	898	−6.0	78	31	898	8.5	44	31	900	6.7	63	31	900	6.4	78	30	896	5.3	56	31	896	−0.6	71	30	906	19.8	80
1,500	31	842	−6.4	69	31	845	4.7	49	31	846	3.3	68	31	847	3.4	79	30	843	1.9	60	31	842	−2.7	68	30	855	16.9	86
2,000	31	790	−8.2	63	31	794	0.7	55	30	795	0.7	68	30	796	0.2	79	30	792	−1.1	64	31	790	−4.9	67	30	806	14.2	78
2,500	31	740	−10.5	60	31	746	−2.8	61	30	747	−2.2	69	30	747	−2.6	78	30	743	−4.3	67	31	741	−7.8	65	30	760	12.0	68
3,000	31	693	−13.2	58	31	700	−6.2	66	30	701	−5.0	68	30	702	−5.5	75	30	698	−7.4	69	31	694	−10.5	65	30	716	9.6	59
4,000	31	607	−18.7	59	30	615	−12.5	69	30	616	−11.0	67	30	617	−11.6	69	30	612	−13.1	63	31	609	−16.1	63	30	634	3.9	59
5,000	30	530	−24.5	55	29	539	−18.9	67	27	540	−17.6	67	30	541	−17.9	65	30	537	−19.1	61	29	533	−21.9	60	29	560	−1.3	61
6,000	30	462	−31.0	54	29	471	−25.8	64	24	472	−24.5	64	28	472	−24.8	61	30	468	−25.6	59	29	464	−28.3	58	29	494	−6.9	55
7,000	28	400	−37.8	52	29	409	−32.7	62	22	411	−31.5	61	21	411	−31.8	61	30	407	−32.6	57	29	403	−35.0	58	29	434	−13.1	47
8,000	28	345	−44.8	.....	29	354	−39.9	61	20	356	−39.0	59	20	356	−39.3	60	30	352	−40.0	57	29	348	−41.3	.....	29	380	−20.0	48
9,000	27	296	−49.6	.....	27	305	−46.9	.....	18	307	−46.1	.....	20	307	−46.4	.....	30	304	−46.6	.....	26	300	−46.6	.....	29	331	−27.0	48
10,000	27	254	−50.4	.....	27	262	−52.2	.....	18	264	−52.6	.....	18	264	−52.4	.....	29	261	−51.2	.....	25	258	−49.2	.....	27	287	−34.3	47
11,000	27	219	−48.8	.....	27	225	−54.4	.....	18	226	−57.2	.....	15	226	−55.9	.....	28	224	−52.9	.....	25	222	−48.6	.....	26	249	−42.1	.....
12,000	26	188	−46.7	.....	23	192	−53.7	.....	17	192	−59.7	.....	12	194	−56.2	.....	28	192	−52.1	.....	24	191	−47.1	.....	25	214	−50.0	.....
13,000	25	161	−46.3	.....	22	164	−51.5	.....	17	164	−57.5	.....	11	165	−53.9	.....	27	164	−50.9	.....	23	164	−45.9	.....	25	183	−57.9	.....
14,000	22	139	−46.4	.....	19	141	−50.5	.....	17	139	−56.4	.....	9	141	−53.7	.....	26	141	−49.8	.....	23	141	−45.5	.....	22	156	−65.0	.....
15,000	17	119	−46.6	.....	15	121	−49.8	.....	17	119	−56.1	.....	8	121	−53.8	.....	26	121	−49.4	.....	21	122	−45.4	.....	22	132	−71.6	.....
16,000	16	102	−46.6	.....	14	104	−49.7	.....	17	101	−55.9	.....	5	103	−53.7	.....	24	104	−49.5	.....	19	105	−45.6	.....	19	111	−75.6	.....
17,000	14	88	−46.2	.....	12	89	−49.3	.....	14	86	−55.4	.....	.....	.....	.....	.....	22	89	−49.3	.....	19	90	−45.6	.....	18	94	−76.8	.....
18,000	11	76	−45.7	.....	9	77	−48.9	.....	12	74	−54.8	.....	.....	.....	.....	.....	16	76	−48.6	.....	16	78	−45.4	.....	15	78	−76.4	.....
19,000	6	65	−45.5	.....	7	66	−48.5	.....	10	62	−54.2	.....	.....	.....	.....	.....	9	65	−47.6	.....	9	67	−44.9	.....	14	66	−73.4	.....
20,000	.....	.....	.....	.....	.....	.....	.....	.....	7	53	−53.7	.....	.....	.....	.....	.....	5	56	−46.7	.....	6	58	−44.4	.....	6	55	−70.0	.....
21,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5	46	−65.9	.....

All observations taken at 11:00 p. m., 75th meridian time.

None of the means included in this table are based on less than 15 surface or 5 standard level observations.

Number of observations refers to pressure only, as temperature and humidity data are missing for some observations at certain levels, also, the humidity data are not used in daily observations when the temperature is below −40° C.

Stations marked with the figure one (1) are Navy stations.

LATE REPORT FOR FEBRUARY, MARCH, AND APRIL

Altitude (meters) m. s. l.	Stations with elevations in meters above sea level															
	FEBRUARY 1942				MARCH 1942				APRIL 1942							
	Pearl Harbor, T. H. (1) (12 m.)				Pearl Harbor, T. H. (1) (12 m.)				Pearl Harbor, T. H. (1) (12 m.)				Swan Island, W. I. (10 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	26	1,015	22.3	73	28	1,016	20.9	72	26	1,017	22.1	69	23	1,013	25.8	77
500	26	959	18.2	71	28	960	16.6	73	26	960	18.2	73	23	957	22.6	83
1,000	26	905	14.9	71	28	905	13.1	76	26	906	14.6	74	23	904	19.3	81
1,500	26	853	12.6	63	28	853	10.5	71	26	854	12.8	61	23	853	16.6	76
2,000	26	803	11.4	50	28	804	9.1	52	26	804	12.2	43	23	804	14.7	63
2,500	26	756	8.6	43	28	756	7.6	37	26	757	10.5	30	23	757	12.7	52
3,000	26	712	5.7	33	28	712	5.1	38	26	713	7.9	20	23	713	10.5	46
4,000	26	628	−0.1	30	28	628	−0.9	24	26	631	1.9	11	21	632	5.3	42
5,000	26	554	−6.6	35	28	553	−7.1	21	26	556	−4.7	8	21	559	0.4	41
6,000	26	487	−13.1	38	26	486	−13.7	21	26	489	−11.3	9	19	493	−5.1	41
7,000	24	426	−19.8	33	26	425	−20.8	33	26	429	−18.1		18	453	−12.0	36
8,000													18	379	−19.0	33
9,000													18	331	−26.4	32
10,000													18	288	−34.0	32
11,000													16	249	−41.8	
12,000													16	214	−50.1	
13,000													15	184	−58.2	
14,000													12	156	−66.9	
15,000													11	132	−75.2	
16,000													10	110	−83.1	
17,000													9	92	−87.3	
18,000													6	76	−91.8	

TABLE 2.—*Free-air resultant winds based on pilot balloon observations made near 5 p. m. (75th meridian time) during May 1942. Directions given in degrees from North (N=360°, E=90°, S=180°, W=270°)—Velocities in meters per second*

Altitude (meters) m. s. l.	Abilene, Tex. (538 m.)			Albuquerque, N. Mex. (1,630 m.)			Atlanta, Ga. (299 m)			Billings, Mont. (1,095 m.)			Bismarck, N. Dak. (512 m)			Boise, Idaho (860 m.)			Brownsville, Tex. (7 m)			Buffalo, N. Y. (220 m.)			Burlington, Vt. (132 m)			Charleston, S. C. (17 m.)			Cincinnati, Ohio (152 m.)			Denver Colo. (1,627 m.)			El Paso Tex. (1,196 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	31	165	3.6	31	222	3.3	30	245	1.1	28	17	1.3	30	75	1.2	---	---	---	31	129	6.5	29	235	3.5	31	185	1.8	30	158	2.0	31	210	1.7	30	80	3.0	31	242	3.4
500							30	231	1.0										31	138	7.2	29	242	4.1	31	197	3.1	30	160	3.4	31	235	3.1						
1,000	31	173	4.9				30	232	1.3				30	58	.9				23	142	5.0	28	239	7.5	31	215	4.2	30	189	1.9	31	241	3.9						
1,500	29	193	5.7				29	250	2.0	28	41	2.0	26	150	1.5				17	129	2.9	25	239	7.4	29	233	5.1	28	225	2.6	28	239	5.6				31	246	5.1
2,000	27	219	6.0	31	224	4.3	28	249	1.9	27	355	.5	21	208	2.7				15	107	1.7	21	256	7.8	27	241	6.8	28	236	2.9	24	241	5.9	30	82	2.4	31	251	5.8
2,500	23	232	7.4	31	228	4.7	26	262	3.6	25	240	2.3	17	245	3.1				14	242	1.0	16	270	8.6	17	261	7.1	28	242	2.9	19	245	6.9	30	110	1.9	31	245	6.0
3,000	22	243	9.4	31	238	6.1	24	263	4.1	22	241	4.7	15	274	4.9				11	267	3.0	11	260	10.3	12	295	8.4	25	229	3.5	14	257	7.7	29	205	2.3	31	246	7.0
4,000	20	255	10.9	31	258	9.3	19	286	4.6	21	251	6.5	13	277	5.5										10	305	9.7	21	258	5.0				24	241	7.0	31	254	11.1
5,000	18	258	11.5	29	264	13.0	16	284	7.6	18	239	8.2																16	263	5.4				20	255	9.4	30	262	13.7
6,000	17	262	14.1	29	260	15.7	14	277	8.7	17	239	10.4																14	263	7.6				13	267	12.8	29	264	15.5
8,000	15	268	17.5	24	269	16.7	11	290	11.4																			11	285	7.4							25	264	19.3
10,000	10	262	21.3	23	268	20.3																															16	275	19.0
12,000				20	270	26.6																															13	278	22.9
14,000				13	269	24.1																															10	282	25.6

Altitude (meters) m. s. l.	Ely, Nev. (1,910 m.)			Grand Junction, Colo. (1,413 m.)			Greensboro, N. C. (271 m.)			Havre, Mont. (767 m.)			Jacksonville, Fla. (16 m.)			Joliet, Ill. (178 m.)			Las Vegas, Nev. (570 m.)			Little Rock, Ark. (88 m.)			Medford, Oreg. (410 m.)			Miami, Fla. (10 m.)			Minneapolis, Minn.* (265 m.)			Mobile, Ala. (66 m.)			Nashville, Tenn. (194 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	30	230	2.6	31	272	1.6	29	201	1.8	30	355	0.8	31	91	4.2	29	234	2.2	31	194	3.4	31	181	2.2	29	342	1.9	31	101	4.9	29	182	0.7	31	176	2.2	31	239	1.5
500							29	212	2.4				31	115	3.3	29	222	3.3				31	187	3.2	29	334	1.9	31	110	5.1	29	199	1.7	31	203	1.9	31	233	2.1
1,000							28	217	3.8	30	48	0.8	31	152	1.0	29	229	5.5	31	203	4.3	31	193	3.8	29	295	1.9	31	98	2.7	29	204	1.9	28	249	0.9	30	215	2.9
1,500							27	227	3.5	30	57	0.7	31	249	1.7	24	248	5.2	31	216	4.1	31	224	4.2	27	253	2.5	29	31	1.2	25	227	3.1	26	319	1.1	29	223	3.1
2,000	30	237	2.5	31	272	2.9	24	252	3.7	28	230	0.3	28	260	2.8	20	253	7.8	31	221	5.3	29	247	5.0	24	218	3.7	28	337	1.8	19	227	2.4	24	299	1.8	25	227	5.4
2,500	30	239	3.2	31	254	4.0	21	273	3.9	26	216	2.3	28	264	3.7	18	252	6.9	31	225	5.4	27	259	6.8	23	214	4.1	24	335	1.4	15	212	3.5	22	292	2.6	24	243	6.4
3,000	29	241	4.0	31	238	5.9	20	268	4.5	22	203	1.9	26	274	4.3	15	265	8.6	30	244	6.4	27	263	7.7	22	227	4.2	24	314	1.6	12	225	2.2	19	300	3.1	22	250	7.7
4,000	23	237	6.8	29	230	9.1	19	264	5.8	15	257	3.9	19	278	4.9	---	---	---	30	260	9.7	23	279	9.8	15	263	5.0	24	287	2.5				16	293	4.7	15	265	7.7
5,000	13	247	12.1	22	252	11.0	17	272	8.9	11	285	5.5	13	285	4.8	---	---	---	29	260	13.7	16	286	13.1	15	270	7.3	22	285	3.3				14	291	6.8	13	263	7.6
6,000				17	259	16.6	16	268	9.3				12	288	7.0	---	---	---	27	260	16.2	11	290	14.4	13	266	9.7	18	289	5.6							10	273	7.4
8,000							12	265	12.1										22	270	23.3				10	277	16.6	14	280	8.5									
10,000							10	270	15.3										19	266	28.3							11	289	13.2									
12,000																			18	269	32.4																		
14,000																			11	267	28.2																		

TABLE 2.—*Free-air resultant winds based on pilot balloon observations made near 5 p. m. (75th meridian time) during May 1942. Directions given in degrees from North (N=360°, E=90°, S=180°, W=270°)—Velocities in meters per second*—Continued

Altitude (meters) m. s. l.	New York, N. Y. (15 m.)			Oakland, Calif. (8 m.)			Oklahoma City, Okla. (402 m.)			Omaha, Nebr. (306 m.)			Phoenix, Ariz. (338 m.)			Rapid City, S. Dak. (982 m.)			St. Louis, Mo. (181 m.)			San Antonio, Tex. (180 m.)			San Diego, Calif. (15 m.)			Sault St. Marie, Mich. (230 m.)			Seattle, Wash. (12 m.)			Spokane, Wash. (603 m.)			Washington, D. C. (24 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	31	176	3.6	31	268	5.9	31	179	3.9	30	179	2.8	31	247	2.1	28	17	1.0	31	216	2.4	31	128	3.2	31	289	4.1	29	273	2.2	30	239	2.1	29	244	1.5	31	185	1.8
500	31	206	5.0	31	282	4.8	31	182	4.4	30	176	2.9	31	256	2.9				31	214	2.3	31	125	4.2	31	275	3.5	29	244	1.3	30	229	2.3				31	208	2.4
1,000	28	247	4.5	30	287	3.5	31	187	5.2	28	188	3.8	31	234	2.4	28	16	0.8	30	213	3.2	30	125	4.5	25	295	2.8	28	229	1.4	27	214	3.1	29	232	1.7	29	234	3.0
1,500	27	259	5.8	28	280	2.4	31	200	6.0	26	207	4.7	31	214	3.1	28	334	1.3	25	226	5.4	25	154	3.9	24	290	2.3	24	203	1.7	21	211	3.0	28	232	1.6	29	251	4.1
2,000	23	268	7.2	27	283	2.9	30	228	7.2	21	222	5.1	31	216	4.4	23	270	2.3	21	242	5.8	23	185	4.3	23	267	2.4	22	253	1.4	18	202	3.0	26	213	1.8	25	259	5.1
2,500	20	268	7.7	27	280	3.7	25	241	8.0	17	230	7.1	31	225	6.3	20	274	4.4	18	244	6.3	19	207	3.8	23	273	4.5	18	290	1.6	16	201	4.3	23	237	2.8	20	259	6.4
3,000	15	277	8.1	27	284	5.3	23	252	10.0	12	246	8.2	31	235	7.6	18	276	6.4	16	255	6.4	15	259	4.4	21	270	7.3	15	303	3.1	14	183	4.9	14	229	3.2	16	246	6.4
4,000				25	290	7.1	21	260	12.3				31	250	10.2	16	290	9.8	10	283	7.6	14	287	6.5	19	276	10.8	13	303	5.3	13	205	4.7				14	266	8.1
5,000				23	285	10.7	20	267	14.1				31	252	13.8	13	297	10.8	10	289	11.1	13	284	7.5	17	271	13.5										11	278	7.0
6,000				21	286	13.5	19	272	14.7				30	258	15.0	11	293	10.9				12	286	9.2	15	269	13.8										11	282	6.8
8,000				15	294	19.5	14	269	18.0				27	262	17.4							10	288	9.7															
10,000				10	283	21.4	11	280	24.4				20	259	23.9																							
12,000													16	268	27.4																							
14,000																																							

*Moved to St. Paul elevation 225 (May 28 to 31 incl.).

TABLE 3.—*Maximum free-air wind velocities, (m. p. s.), for different sections of the United States, based on pilot-balloon observations during May 1942*

Section	Surface to 2,500 meters (m. s. l.)					Between 2,500 and 5,000 meters (m. s. l.)					Above 5,000 meters (m. s. l.)				
	Maximum velocity	Direction	Altitude (m) m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m) m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m) m. s. l.	Date	Station
Northeast [1]	42.4	W	1,860	3	Akron, Ohio	41.2	W	4,780	5	Boston, Mass.	61.6	SSW	10,020	25	Portland, Maine.
East-Central [2]	28.1	SSW	990	7	Hatteras, N. C.	32.2	W	4,350	7	Knoxville, Tenn.	54.0	SW	7,650	27	Hatteras, N. C.
Southeast [3]	27.6	SSW	2,500	3	Birmingham, Ala.	29.5	SSW	2,630	3	Birmingham, Ala.	40.0	WSW	11,600	22	Tampa, Fla.
North-Central [4]	39.5	SW	1,000	2	Detroit, Mich.	35.0	WNW	4,960	5	Alpena, Mich.	56.0	WSW	9,520	28	Bismarck, N. Dak.
Central [5]	43.0	SW	1,530	11	St. Louis, Mo.	42.0	SW	3,090	13	Des Moines, Iowa.	40.0	W	8,910	4	St. Louis, Mo.
South-Central [6]	32.9	SW	2,090	16	Amarillo, Tex.	34.0	SW	3,980	13	Oklahoma City, Okla.	58.5	W	11,110	15	Oklahoma City, Okla.
Northwest [7]	27.5	ESE	1,380	10	Havre, Mont.	29.2	WSW	3,010	27	Great Falls, Mont.	53.0	WNW	11,000	6	Boise, Idaho.
West-Central [8]	44.9	NW	2,090	13	Cheyenne, Wyo.	49.6	W	4,650	27	Reno, Nev.	68.0	NW	10,070	1	Redding, Calif.
Southwest [9]	41.0	SSW	2,280	30	Roswell, N. Mex.	51.2	SSW	3,360	26	Las Vegas, Nev.	65.3	W	7,530	2	Albuquerque, N. Mex.

[1] Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania and Northern Ohio.
[2] Delaware, Maryland, Virginia, West Virginia, Southern Ohio, Kentucky, Eastern Tennessee and Northern Carolina.
[3] South Carolina, Georgia, Florida and Alabama.
[4] Michigan, Wisconsin, Minnesota, North Dakota and South Dakota.
[5] Indiana, Illinois, Iowa, Nebraska, Kansas and Missouri.
[6] Mississippi, Arkansas, Louisiana, Oklahoma, Texas (except El Paso), and Western Tennessee.
[7] Montana, Idaho, Washington and Oregon.
[8] Wyoming, Colorado, Utah, Northern Nevada and Northern California.
[9] Southern California, Southern Nevada, Arizona, New Mexico, and extreme West Texas.

RIVER STAGES AND FLOODS

By BENNETT SWENSON

Devastating floods occurred in several tributaries of the Delaware and Susquehanna Rivers on May 22–23. Among the streams most seriously affected were the Lackawaxen, Lackawanna, Lehigh, and Schuylkill Rivers. Thirty-three lives were lost in Pennsylvania, due directly or indirectly to the floods, and property damage caused by the floodwaters has been estimated at $13,000,000.

At the same time, excessive flooding occurred in headwater areas along a narrow fringe extending from the Delaware River Basin southwestward to western North Carolina.

In addition to high water and flooding in the Missouri, Arkansas, Red, and Trinity Rivers, continuing from April, numerous local floods occurred in various areas, severe in some cases, in the upper Mississippi Basin, and in the Dakotas and Montana.

The flow in the upper Rio Grande continued high and storage in New Mexico was the highest of record.

Atlantic Slope drainage.—Floods occurred during the month in most streams from the Delaware River Basin, southward to South Carolina. Especially damaging were the floods of May 22–23 in tributaries of the Delaware and Susquehanna Rivers in eastern Pennsylvania and adjacent portions of New York and New Jersey. The Lackawaxen, Lehigh, and Schuylkill Rivers of the Delaware Basin, and the Lackawanna River draining into the Susquehanna River were the streams most seriously affected.

In the Lackawaxen River at Hawley, Pa., the crest was the highest ever known; in the Lehigh River at Bethlehem, Pa., the second highest of some 150 years of record occurred; in the Schuylkill River at Reading, Pa., the third highest stage of record since 1757 was reached; and in the Lackawanna River a stage of 2.6 feet above the high stage of March 1936 occurred at Scranton, Pa.

The greatest devastation occurred in the Lackawaxen River Basin. Of the 33 deaths in Pennsylvania, attributed directly or indirectly to the floods, 24 persons are known to have drowned or are still missing in this basin. Of the estimated $13,000,000 damage caused by the floodwaters, 45 percent has been fixed for the Lackawaxen Basin. Five deaths and 45 percent of the damage occurred in the Schuylkill and Lehigh River Basins.

The weather preceding the floods was characterized by frequent rains over most of this area, during the first 3

weeks of May, with a period of heavy rains on the 16th–17th. Beginning on the 19th, successive heavy showers continued until the early morning of the 23d, the greatest intensity occurring generally between afternoon and midnight of the 22d.

The following meteorological analysis of the heavy precipitation of May 19–23 was prepared by the Weather Bureau Office, Harrisburg, Pa.:

The weather over the Susquehanna and Delaware River Basins during May 1942 was characterized by numerous periods of copious rainfall. These heavy rains developed from recurring clashes between warm moist currents of air advancing from the West Gulf Region into the Upper Ohio Basin and deep colder air currents advancing southeastward from Montana and the Dakotas. The circulations of these two radically different currents created a tendency for a cold cyclonic circulation aloft over the Lower Lake Region and the Middle Atlantic States. This contrast was frequently intensified by the presence of a second current of warm moist air advancing up the Atlantic Coast to the vicinity of the Chesapeake Bay Region. Thus was created a sufficient supply of moisture over eastern Pennsylvania and adjacent areas from which nature could produce heavy precipitation. On one or two occasions, the circulation was so complete that the normally dry air coming into Pennsylvania from the north and northwest was practically saturated although, moderately cool.

The rainfall period of the 19th to the 23d with very heavy rain recorded over the watersheds began with a moderately strong high pressure system becoming stationary over the Atlantic adjacent to the New England and New Jersey coasts. This prevented a weak frontal system, moving slowly eastward north of the Lakes, from passing across Pennsylvania normally. Another high pressure system developed over the Mississippi Valley and Western Lakes Region. During this time the Atlantic High continued a slow steady circulation of moist air in from the southeast, while warm moist air from the Gulf moved northward through the quasi-stationary frontal zone. The Mississippi Valley high pressure circulation continued slowly and steadily to bring in much colder air from the northwest in the surface layers, while aloft over Central United States the presence of cold air resulted in the formation of a cold cyclonic circulation of dry air. The momentum of this cyclonic eddy as it moved eastward helped to deepen and accelerate the northward flow of warm moist air from the Atlantic. The area of maximum convergence in the moist current over the western portion of the Delaware drainage area was also the area in which the initial orographic lifting of the warm moist current began. While earlier periods of rain were coincident with surges along the nearly stationary frontal system that persisted over Pennsylvania for approximately 5 days, the very heavy rains of May 22–23 occurred as a wave on the quasi-stationary front deepened and moved rapidly northward beyond Lake Ontario.

The contrast between the inherent qualities of the air masses on either side of the quasi-stationary front appeared remarkably strong on the midnight map of May 21–22. The Washington radiosonde showed a moisture content of 13.6 g./kg. at the surface, 13 g./kg. at 915 mbs. (3,000 ft. m. s. l.), and 8 g./kg. at 700 mbs. (8,500 ft. m. s. l.), while just under the level of freezing temperature (32° F.) on the sounding (near 12,000 ft.) the relative humidity was still high—94 percent with moisture content of 6 g./kg. This moist air was being slowly compressed against the eastern slopes of the Appalachians and being forced to ascend over the colder air which, in the lower levels, had a maximum saturation of 6–7 g./kg. As the moist air was conditionally unstable slight orographic lifting was required to set off heavy rain showers in northeastern Pennsylvania, southern New York and northwestern New Jersey. Extreme southeastern Pennsylvania and southern New Jersey received extremely light amounts of rain, although the same moist air current first moved over this area. Disastrous flash-floods in Delaware and Sullivan Counties of New York State and in eastern Pennsylvania reached their peak on the 23d due to excessive rainfall on the night of the 22d–23d.

The damage caused by the floods of May 22–23 in the Delaware River Basin (exclusive of the Schuylkill) is evaluated at approximately $11,500,000. This figure includes all tangible losses, such as destruction of property (both residential and industrial), agriculture, highway and railroad damage. Intangible losses, such as loss of wages of employees, are not included. About one-half of the damage is estimated to have occurred along the Lackawaxen River, over 40 percent along the Lehigh River, and the remainder elsewhere. In the Lackawaxen Basin alone, 24 lives were lost, of which 12 deaths occurred at Honesdale, Pa., and 9 deaths at Hawley, Pa. One death was reported at Allentown, Pa., in the Lehigh River Basin as the result of the flood.

The following is quoted from a letter received at the Weather Bureau Office, Trenton, N. J., from Mrs. Della Pennell, river observer at Hawley, Pa., relative to the flood at that place (times given are Eastern War Time):

I, among others at Hawley, am suffering from nervous strain due to that disastrous flood, the worst in the history of our town, that came so suddenly in the night of May 22–23. The waters began to recede about the middle of forenoon on the 23d. The highest river stage reading I got was 5.89 feet at 8 a. m. on the 22d. I took second reading at 1:15 p. m. and found the river had fallen to 5.69 feet, and as rain was light the remainder of the day, a flood did not seem imminent. It began to rain harder by showers at 5:30 p. m. continuing heavier and heavier when at about 10 p. m., volumes of water came down, never heard anything like it. Thunder and lightning accompanied the showers which continued until 3 a. m. the following day, when to our consternation, we found that we, on the east side, were cut off from all communications with the west side, or main part of town, and all other places. The bridge at the eddy where the gage was, had been swept away about 4 a. m. on the 23d soon after the other bridge over the Lackawaxen farther up stream went down. Buildings were carried away. Nine of our citizens were drowned, who went to their doom in their homes. I am sorry that at that most critical time I was unable to submit any information to you, with gage gone, no telegraph or telephone and not even mail service until following Tuesday (26th). The heavy rain was considered due to a cloud burst that was quite widespread. Much of Hawley, especially on low lands represents a shamble; loss to town is estimated to be one-half million dollars. The greatest volume of water fell between the hours of 10 p. m. May 22 and 3 a. m. of the 23d. Living on high ground, I was in no danger from flood at any time.

Losses in the Schuylkill River Basin have been estimated at over a million dollars and four lives were lost. From the survey that was made to determine the losses, most of the damage occurred at Reading, Pa. At that place a crest stage of 22 feet was reached between 7:30 and 9:30 a. m., E. S. T., of the 23d. In August 1933, a stage of 22.7 feet occurred.

Rain that fell over the Schuylkill River watershed on May 16–17 had thoroughly soaked the soil and all streams were running at high stages on the morning of the 21st. Scattered showers and thunderstorms occurred over portions of the watershed during the 21st and the forenoon of the 22d. In the afternoon and evening of the 22d, unusually heavy thundershowers again occurred over the basin above Reading. The rain ceased generally by midnight of the 22d–23d.

Rainfall amounts measured during the periods May 16–17 and 21–23 are as follows (the figures represent the 7 a. m. to 7 a. m., E. S. T., accumulated 24-hour amount of May 16–17 and the 72-hour amount of May 20–23, respectively): Myerstown, Pa., 2.07 and 4.37 inches; Pottsville, Pa., 2.86 and 5.60 inches; Tamaqua, Pa., 3.20 and 6.97 inches; Reading, Pa., 2.04 and 5.81 inches; Port Clinton, Pa., 2.90 and 6.69 inches; and Sellersville, Pa., 1.50 and 0.58 inches.

Of considerable importance is the fact that while heavy rains occurred in the Schuylkill Basin above Reading, the rains were very light in Perkiomen Creek which drains into the Schuylkill below Reading. This is represented by the rainfall amounts for Sellersville, listed immediately above. Had heavy rains occurred there much higher stages would have been reached in Philadelphia, which, as it was, escaped serious damage.

In the main Delaware River, the flooding was relatively light, except at Easton, Pa., where the Lehigh River empties into the Delaware, and immediately below. At Easton a stage of 28 feet, 6 feet above flood stage, was reached on May 24. A crest of 11.24 feet occurred at

Trenton, N. J., during the evening of May 23; this was followed by another rise, reaching a crest of 13.35 feet the morning of May 24.

Most of the streams in the upper Susquehanna River Basin were in flood on May 22–23 but the damage was relatively light except in the Lackawanna River Basin where destructive flooding took place as indicated previously.

Showers of excessive intensity began over the Lackawanna River watershed in the afternoon of the 22d and ended generally by midnight. The heaviest amount reported, 7 inches between 2 and 11 p. m., E. S. T., was measured at a station one mile east of Carbondale, Pa. Scranton, Pa., received only 2.65 inches in approximately the same period.

The Lackawanna River began rising rapidly shortly after the heavy rains began. In the evening the river stage at Scranton was 5.7 feet, flood stage 7 feet, and at 3 a. m. the next day (May 23) a crest stage of 11.6 feet was reached.

Considerable damage occurred at Scranton and in the valley between there and Carbondale. Damage estimates approximate $800,000, with some 5,000 buildings inundated and 7 bridges destroyed. Only one death resulted (indirectly) from the flood.

Mr. West, Weather Bureau office, Scranton, Pa., comments as follows relative to weather phenomena observed during the afternoon of May 22:

> As is often the case in the warmer months of the year, a thunderstorm developed over the West Mountain Ridge to the west of this city (Scranton) between 2 and 3 p. m. It seemed to move northeastward, paralleling the range and then was followed by further development to the southwest along the mountains and over the Lackawanna Valley. By a little after 4 p. m. the rain was falling in torrents, and continued until after 6 p. m. when there was a short lull followed by another spell of less intense rain between 7 and 8 p. m. A total of 2.65 inches of rain was recorded between 4 p. m. of the 22d to 1 a. m. of the 23d. We have had storms of much greater intensity of rainfall but none with such heavy rain over such a wide area.[1] As stated earlier, the storm activity seemed to grow along the West Mountain Range and to spread eastward from it.

The following tabulation gives the flood crest heights of the floods of May 1942, and the crests of previous maxima at several points in the tributaries of the Delaware and Susquehanna Rivers:

River and station	Period of record	Previous maximum		May 1942 gage height
		Date	Gage height	
Delaware River Basin:				
Lackawaxen River:			*Feet*	*Feet*
Hawley, Pa.[1]	1908	1936	13.9	20.13
Lehigh River:				
Lehighton, Pa.	1934	1936	13.1	15.6
Schuylhill River:				
Reading, Pa.	1757	1850	23.2	22.0
Pottstown, Pa.[1]	1902	1902	21.0	20.15
Susquehanna River Basin:				
Lackawanna River:				
Scranton, Pa.	1936	1936	9.0	11.6

[1] Record from U. S. Geological Survey.

Two rises occurred in the Potomac and James River Basins during the month. The first rise followed heavy rains on May 15–16 centered over the upper James River and the upper tributaries in the Potomac Basin. The rainfall amounts averaged 4 inches in the James Basin above Lynchburg, Va., about 2 inches in the North Branch of the Potomac above Cumberland, Md., and about 2.25 inches in the South Branch above Springfield, W. Va., and in the Shenandoah River above Riverton, Va. Maximum amounts reported were over 6 inches at Montebello and Balcony Falls, Va., in the James Basin and 4.5 inches at Monterey, Va., in the Potomac Basin.

Showers occurred again on the 20th followed by heavy rains late on that day and continuing until the morning of the 22d, most of the rain occurring during the last 24 hours. The distribution of the rains on May 21–22 duplicated that of the storm of May 15–16 to a great extent. Generally in the second storm the amounts were somewhat less over the James Basin than in the first storm while in the Potomac Basin, the reverse was true except in the North Branch of the Potomac where the rainfall of May 21–22 was relatively light.

While no appreciable flooding resulted in the Potomac Basin from the first storm, the second storm produced the highest general rise in that basin since 1937. Losses were confined generally to the headwater areas and consisted principally of damage to prospective crops, land, fences, roads and bridges, with an estimated total loss of more than $145,000 from incomplete reports. The crest reached Washington, D. C., on the afternoon of May 24 with a stage of 13.2 feet (flood stage 10 feet) at the Leiter gage above the city and 6.0 feet on the gage at the foot of Wisconsin Avenue (flood stage 7 feet).

In the James River Basin, general flooding occurred from both storms, the former rise being greater in the upper reaches while the latter rise attained greater heights in the lower reaches. The river crested at Richmond, Va., at 9.8 feet on May 18–19 and at 12.4 on May 24–25 (flood stage 8 feet). The losses in the James River floods totaled over $16,000, about equally divided between the two floods and in both cases generally confined to the upper reaches.

Light to moderate overflows occurred in the Roanoke, Neuse, Peedee, and Santee River Basins from moderate to heavy rains on May 20–22. No damage of consequence was reported except in the Roanoke River, where a loss of $13,500, mostly to prospective crops, occurred.

East Gulf of Mexico drainage.—The only flooding in the drainage took place in the Pearl River. The flooding, which was light, resulted from showers from the 12th to the 15th. The rainfall amounts varied from 2 to more than 8 inches during the storm period. Flood stage was exceeded at Monticello, Miss., by 0.4 foot and at Pearl River, La., by 1.8 foot.

Upper Mississippi Basin.—Thundershowers with excessive rainfall were quite general in the extreme upper Mississippi Valley and tributary streams from May 25 and extending to June 1. The area of heaviest precipitation was in the Chippewa and upper Wisconsin River Basins and in the section of the main Mississippi channel from St. Paul-Minneapolis to Lake Pepin. Light to moderate flooding occurred in the Chippewa, Wisconsin, Zumbro and Whitewater Rivers. The flooding continued into June and a detailed account of the flooding can not be given at this time.

Slight overflows occurred in the Des Moines River from the vicinity of Tracy, to Eddyville, Iowa, on May 13–14 and in the Meramec River Basin in Missouri, but there was no damage of consequence.

Missouri River Basin.—Scattered local floods occurred in small streams in Montana and the Dakotas. On May 13, severe flooding in the South Fork of McDonald Creek caused damage estimated at $12,000. The flood resulted from heavy rain on the snow-laden eastern slope of the Big Snowy Mountains. On May 24, overflows of small creeks near Rothiemay, Mont., caused by a heavy thundershower, resulted in damage amounting to $4,000.

[1] Reports received later showed that 7 inches of rain fell between 2 and 11 p. m., May 22, near Carbondale in the valley above Scranton.

During the latter part of the month some flooding occurred in the Sun and Missouri River Valleys near Great Falls, Mont. In South Dakota, a flash flood in Horsehead Creek near Oelrichs, killed five people and damaged railroad tracks.

Heavy rains in southeastern South Dakota from May 12–14, produced exceptionally high stages in the James and Big Sioux Rivers. In some cases the highest stages of record were reached or exceeded. The stages remained above flood stage for several days.

Floods occurred in the upper Solomon River at Beloit, Kans., and in the upper reaches of the Big Blue and Little Blue Rivers. The overflow in the Solomon River was slight and of short duration; the crest at Beloit was 3 feet above bankful on the 4th. In the Little Blue River the flooding was also light and confined to Nebraska areas. The crest of Beatrice, Nebr., on the Big Blue River was 1.6 feet above bankful on the 11th; at Barnston, Nebr., 6.2 feet above bankful on the 12th; and at Blue Rapids, Kans., 5.5 feet above bankful at midnight of the 12th–13th. Below the confluence of the Big and Little Blue Rivers the overflow was slight.

Damage from the flooding in the Blue River Basin in Kansas and Nebraska was estimated at $43,000, most of which occurred in Gage County, Nebr., and in Marshall County, Kans., along the Big Blue River. Lower sections of Marysville, Kans., and Beatrice, Nebr., were flooded, the latter largely by creeks in flash floods, with considerable damage to city property, which is included in the above estimate.

The Grand River in Missouri was in light flood on two occasions during the month, on the 6th to the 8th and again from the 11th to the 29th.

On May 5, a flash flood induced by excessive precipitation in extreme northwestern Missouri caused slight property loss and moderate crop damage along the Tarkio River.

The Nemaha River in Richardson County, Nebr., was out of its banks on May 11–15. Severe damage was inflicted on highways, bridges and buildings with moderate crop damage.

Excessive rain which fell over the upper Salt Creek Basin in southern Lancaster County during the night of May 10–11, caused flood conditions in small streams and considerable damage between DeWitt and Lincoln, Nebr., and in parts of the City of Lincoln where one man was drowned and property damage was severe. Light damage was reported at a few places along Salt Creek between Lincoln and Ashland, Nebr.

The Missouri River at Nebraska City, Nebr., left its banks on May 6 and remained above flood stage until May 26. The flood, which was augmented by excessive precipitation in eastern Nebraska on May 11–12, crested at 18.43 feet on May 21, the highest stage of record at that point. Extensive flooding, especially in Fremont and Mills County, Iowa, occurred with severe loss to prospective crops.

In the extreme lower Missouri River, light to moderate flooding prevailed in the entire reach from Lexington, Mo., to its mouth.

Ohio River Basin.—Heavy rains occurred in the upper basin of the French Broad River on the morning of May 20 and continuing as light to moderate to light rain on May 21, caused the river to overflow until May 23. Although the average rainfall over the entire basin was not excessive, over 8 inches of rain occurred in the watersheds of the upper basin. The crest stage exceeded flood stage by almost 4 feet in the central portion of the basin and slightly less in the lower portion.

The greatest damage was inflicted in Henderson County, in the upper basin, where the heavy rain together with the overflow caused losses to crops, roads, bridges, cattle, and soil. Very little damage was reported in the middle basin, and none at all in the lower portion.

White-Arkansas-Red Basins.—Widespread floods in these basins during April, referred to in the April issue of the REVIEW, continued into May. As full information has not yet been assembled, the report on these floods will be made in the next issue of the REVIEW.

West Gulf of Mexico drainage.—The unusually high flood in the Trinity River during April continued into May. Further rains in May produced additional crests in the upper reaches but they were not as high as those in April. In the lower reaches the main crest was reached during May. A full report of these floods will be given in the next issue of the Review.

Precipitation over the watershed of the Rio Grande in New Mexico was the greatest of record for April, and a heavy flow into Elephant Butte Lake took place. Although high stages continued during both April and May, no serious peaks occurred. One rise occurred in the river above Elephant Butte Lake on April 23, and there were several minor levee breaks, but no appreciable damage occurred. There were two more peaks in May but as in April they passed without any serious damage. At the beginning of June, there was more stored water in New Mexico than ever before.

On April 13, water was allowed to pass through the spillway gates of Elephant Butte Dam. The amount released was increased irregularly until May 16. The river channel downstream was able to accommodate the heavy flow until the water reached the Candelaria-Presidio irrigation district, a narrow stretch extending along the river for about 40 miles. The highest stage in this reach occurred about May 27 and the flood continued after the end of May. About 3,500 acres of farm land were flooded on the American side of the river.

In the lower Rio Grande, flood stage was exceeded by .7 foot at Mercedes, Tex., on May 22–23.

Gulf of California drainage.—Run-off from melting snow produced high stages in the Gunnison and upper Colorado River during April and May. Two crests in April and two in May, at or above flood stage, were reached in the Gunnison River at Delta, Colo. The highest crest, 11.4 feet, occurred on May 27. The Colorado River, at Grand Junction, reached flood stage (11 feet) on May 27–28. Damage from the high water was slight.

Pacific Slope drainage.—Kings River was above flood stage at Piedra, Calif., on May 22–26 as a result of the first warm spell. No damage occurred as a maximum amount of water was used for irrigation purposes with the excess amounts going into Tulare Lake Basin.

The Columbia River reached a stage of 16.4 feet (flood stage 15 feet) at Vancouver, Wash., on May 30. No damage occurred.

NOTE.—A tabulation of flood losses and savings for May will be given in the next issue of the REVIEW, as estimates are to a great extent incomplete at this writing.

FLOOD-STAGE REPORT FOR MAY 1942

[All dates in May unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ATLANTIC SLOPE DRAINAGE					
Lehigh:	*Feet*			*Feet*	
Lehighton, Pa.	7	22	24	15.6	23
Bethlehem, Pa.	16	22	24	25.6	23
Schuylkill:					
Pottsville, Pa.				8.85	23
Port Clinton, Pa.				12.5	22–23
Reading, Pa.	13	22	24	22.0	23
Delaware:					
Port Jervis, N. Y.	18			17.6	23
Dingman's Ferry, Pa.				19.4	23
Portland, Pa.				15.9	24
Easton, Pa.	22	23	24	28.0	24
Frenchtown, N. J.				18.6	24
Lambertville, N. J.				16.2	24
Trenton, N. J.	12	24	24	13.35	24
Chenango:					
Sherburne, N. Y.	8	23	23	8.7	23
Greene, N. Y.	8	23	24	8.4	23
Chemung:					
Elmira, N. Y.	12	23	23	12.0	23h
Chemung, N. Y.	12	23	23	13.5	23
Lackawanna: Scranton, Pa.	7	22	23	11.6	23
Susquehanna:					
Oneonta, N. Y.	12	22	25	15.75	23
Bainbridge, N. Y.	12	23	24	13.3	24
Vestal, N. Y.	14	23	25	16.4	23
South Branch of Potomac:					
Springfield, W. Va.	15	22	23	20.1	23
Potomac:					
Harpers Ferry, W. Va.	18	23	24	18.6	24
Washington, D. C. (Leiter gage)	10	23	25	13.2	24
James:					
Buchanan, Va.	17	16	17	19.65	17
		22	23	18.25	22
Lynchburg, Va.	18	22	22	18.3	22
Scottsville, Va.	20	23	23	21.2	22
Bremo Bluff, Va.	19	17	18	23.7	18
		22	24	26.3	23
Columbia, Va.	10	16	20	23.9	18
		21	26	26.8	23
Richmond, Va.	8	18	19	9.8	18–19
		23	25	12.4	24–25
Danville: Danville, Va.	11	23	23	11.0	23
Roanoke:					
Randolph, Va.	21	23	24	24.0	24
Weldon, N. C.	31	18	19	32.7	19
		24	26	37.5	25
Williamston, N. C.	10	26	June 2	10.9	30
Neuse:					
Neuse, N. C.	14	18	19	14.3	19
Lynches:					
Effingham, S. C.	14	28	29	14.3	29
Pee Dee:					
Cheraw, S. C.	30	23	24	30.25	23
Mars Bluff Bridge, S. C.	17	25	30	18.7	27–28
Saluda:					
Pelzer, S. C.	6	22	23	8.3	22
Catawba:					
Catawba, N. C.	8	21	23	10.4	22
Wateree:					
Camden, S. C.	23	23	23	23.0	23
Savannah:					
Clyo, Ga.	11	(3)	Apr. 20	(3)	(3)
		29	(4)		
EAST GULF OF MEXICO DRAINAGE					
Pearl:					
Monticello, Miss.	15	16	16	15.4	16
Pearl River, La.	12	20	23	13.8	22
MISSISSIPPI SYSTEM					
Upper Mississippi Basin					
Chippewa: Holcombe, Wis.	22	30	June 3	25.9	30–31
Zumbro: Theilman, Minn.	36	29	June 2	37.3	June 1
Wisconsin:					
Knowlton, Wis.	12	30	June 2	18.65	31
Wisconsin Rapids, Wis.	12	June 1	June 1	12.2	June 1
Des Moines:					
Tracy, Iowa	14	13	14	14.4	14
Eddyville, Iowa	15	13	14	15.2	14
Bourbeuse:					
Union, Mo.	12	29	29	12.9	29
Meramec:					
Sullivan, Mo.	11	27	27	12.1	27
Pacific	11	28	29	14.0	29
		31	(4)	15.8	June 1
Missouri Basin					
Solomon:					
Beloit, Kans.	18	3	4	21.0	4
Little Blue:					
Endicott, Nebr.	11	12	12	12.8	12

See footnotes at end of table.

FLOOD-STAGE REPORT FOR MAY 1942—Continued

[All dates in May unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
MISSISSIPPI SYSTEM—continued					
Missouri Basin—Continued					
Big Blue:	*Feet*			*Feet*	
Beatrice, Nebr.	16	11	12	17.6	11
Barnston, Nebr.	18	11	13	24.2	12
Blue Rapids, Kans.	20	12	13	25.5	12–13
Randolph, Kans.	22	13	13	22.4	13
Grand:					
Chillicothe, Mo.	18	6	7	20.2	6
		12	13	18.6	12
Brunswick, Mo.	12	7	8	12.3	8
		11	20	14.4	17
Missouri:					
Blair, Nebr.	18	18	22	18.8	19
Nebraska City, Nebr.	15	6	26	18.4	21
Lexington, Mo.	18	6	30	22.3	16
Waverly, Mo.	18	13	19	19.25	16
		21	29	18.9	28
Boonville, Mo.	21	27	27	21.1	27
Hermann, Mo.	21	16	16	21.0	16
		18	20	22.3	19
		27	29	23.1	27
St. Charles, Mo.	25	14	23	27.6	20
		27	31	28.0	29
Ohio Basin					
French Broad:					
Asheville, N. C.	6	20	23	9.8	21
Hot Springs, N. C.	8	21	23	11.45	21
White Basin					
Black:					
Black Rock, Ark.	14	5	6	16.2	5
White:					
Georgetown, Ark.	21	Apr. 11	12	24.8	Apr. 17
				22.2	Apr. 30
Des Arc, Ark.	24	Apr. 13	5	27.6	Apr. 18–19
				24.8	1
Clarendon, Ark.	26	Apr. 13	17	29.3	Apr. 21–22
St. Charles, Ark.	25	Apr. 16	20	27.7	Apr. 27–28
Arkansas Basin					
Purgatoire:					
Higbee, Colo.	2	Apr. 22	Apr. 24	8.0	Apr. 23
Petit Jean:					
Danville, Ark.	20	21	23	22.0	22
Arkansas:					
Lamar, Colo.	8	Apr. 24	Apr. 24	8.8	Apr. 24
Dodge City, Kans.	5	Apr. 23	5	7.75	Apr. 28
Wichita, Kans.	9	5	7	9.8	5
Webbers Falls, Okla.	23	Apr. 25	2	29.8	Apr. 28
Ft. Smith, Ark.	22	Apr. 21	4	31.2	Apr. 27
Van Buren, Ark.	22	Apr. 22	4	31.3	Apr. 30
Ozark, Ark.	22	Apr. 26	3	28.2	Apr. 30
Dardanelle, Ark.	22	Apr. 26	4	28.7	1
Morrilton, Ark.	20	Apr. 26	5	25.4	2
Little Rock, Ark.	23	Apr. 28	4	24.8	2
Pine Bluff, Ark.	25	Apr. 28	6	27.7	3
Red Basin					
Ouachita:					
Arkadelphia, Ark.	17	Apr. 29	Apr. 30	23.6	Apr. 29
Camden, Ark.	26	Apr. 28	7	34.3	3
Sulphur:					
Hagansport, Tex.	33	7	7	38.3	7
		18	22	40.3	19
Naples, Tex.	22	Apr. 24	6	28.4	Apr. 25
		18	29	27.6	22
Cypress:					
Jefferson, Tex.	18	22	26	20.6	23
Red:					
Index, Ark.	25	Apr. 26	5	30.4	1
Fulton, Ark.	25	Apr. 21	3	33.3	2
Grand Ecore, La.	33	Apr. 16	16	39.6	7–9
		21	26	33.6	24
Alexandria, La.	32	Apr. 14	31	40.6	11–12
Lower Mississippi Basin					
Big Lake Outlet:					
Manila, Ark.	10	Apr. 10	1	14.3	Apr. 16–17
Tallahatchie:					
Swan Lake, Miss.	26	Apr. 11	2	29.3	Apr. 16
WEST GULF OF MEXICO DRAINAGE					
Sabine:					
Logansport, La.	25	Apr. 20	28	32.0	Apr. 24
West Fork of Trinity:					
Fort Worth, Tex.	17	19	19	19.1	19
Elm Fork of Trinity:					
Carrollton, Tex.	6	19	21	10.0	20
East Fork of Trinity:					
Rockwall, Tex.	10	7	9	11.0	8
		19	24	13.8	20

FLOOD-STAGE REPORT FOR MAY 1942—Con.

[All dates in May unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
WEST GULF OF MEXICO DRAINAGE—CON.					
Trinity:	*Feet*			*Feet*	
Dallas, Tex.	28	Apr. 19	6	45.4	Apr. 21
				45.8	Apr. 26
		6	11	29.4	8
		19	28	37.6	20
Trinidad, Tex.	28	Apr. 8	(1)	49.8	Apr. 25
				39.0	25
Long Lake, Tex.	40	Apr. 12	14	51.6	Apr. 29
		24	(2)	42.6	28
Riverside, Tex.	40	1	16	52.7	6
Liberty, Tex.	24	Apr. 10	(2)	28.9	14
Rio Grande:					
Mercedes, Tex.	21	22	23	21.7	22–23
GULF OF CALIFORNIA DRAINAGE					
North Fork of Gunnison:					
Paonia, Colo.	9	9	12	9.6	12
		21	28	9.7	24

[1] 8 a. m. reading, probably not crest.
[2] Continued from March.
[3] Crest occurred in March.

FLOOD-STAGE REPORT FOR MAY 1942—Con.

[All dates in May unless otherwise specified]

River and station	Flood state	Above flood stages—date		Crest	
		From—	To—	Stage	Date
GULF OF CALIFORNIA DRAINAGE—con.					
Gunnison:	*Feet*			*Feet*	
		Apr. 15	Apr. 17	9.6	Apr. 15
		Apr. 23	Apr. 23	9.0	Apr. 23
Delta, Colo.	9	9	13	11.1	11
		22	(4)	11.4	27
Green:					
Elgin, Utah	12	31	(4)		
Colorado:					
Grand Junction, Colo.	11	27	28	11	27–28
PACIFIC SLOPE DRAINAGE					
San Joaquin Basin					
Kings:					
Piedra, Calif.	10	22	26	10.95	26
Columbia Basin					
Columbia:					
Vancouver, Wash.	15	28	(4)	16.4	30

[4] Continued into following month.
[5] Approximated.

CLIMATOLOGICAL DATA

CONDENSED CLIMATOLOGICAL SUMMARY OF TEMPERATURE AND PRECIPITATION BY SECTIONS

[For description of tables and charts, see REVIEW, January 1940, p. 32]

In the following table are given for the various sections of the climatological service of the Weather Bureau the monthly average temperature and total rainfall; the stations reporting the highest and lowest temperatures, with dates of occurrence; the stations reporting the greatest and least total precipitation; and other data as indicated by the several headings.

The mean temperature for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperatures and precipitation are based only on records from stations that have 10 or more years of observations. Of course, the number of such records is smaller than the total number of stations.

Section	Temperature								Precipitation					
			Monthly extremes								Greatest monthly		Least monthly	
	Section average	Departure from the normal	Station	Highest	Date	Station	Lowest	Date	Section average	Departure from the normal	Station	Amount	Station	Amount
	°F.	°F.		°F.			°F.		In.	In.		In.		In.
Alabama	71.4	0.0	Geneva	97	28	Fayette	38	9	3.40	−0.72	Hightower	7.20	Moulton	0.19
Arizona	63.8	−2.3	Mohawk	112	[1] 20	Jadito	10	12	T	−.33	Junipine	.40	117 stations	.00
Arkansas	68.0	−1.1	Okay	100	30	Gravette	36	4	3.89	−.99	Mammoth Spring	10.16	St. Charles	.93
California	58.5	−2.9	Brawley	112	20	Ellery Lake	−4	12	1.75	+.79	Elk Valley	9.53	46 stations	.00
Colorado	52.0	−.4	2 stations	102	26	Silverton	6	1	.90	−.97	Sedgwick	4.43	5 stations	.00
Florida	75.2	−.3	De Funiak Springs	96	19	2 stations	45	[1] 9	3.37	−.53	Dania	8.75	Gainesville	.54
Georgia	71.3	−.3	2 stations	95	[1] 5	Tallapoosa	38	[1] 9	4.29	+.89	Clayton	11.00	Alma	1.17
Idaho	49.6	−3.5	Lewiston	95	21	Sun Valley	10	11	3.14	+1.47	Winchester	5.72	Idaho Falls	.57
Illinois	63.0	+.2	Ottawa	96	[1] 29	5 stations	33	[1] 5	4.19	+.18	Barry	8.03	Joliet (Airport)	1.52
Indiana	63.5	+1.2	Vevay	99	29	4 stations	31	[1] 5	4.04	+.08	Noblesville	6.29	Angola	1.82
Iowa	59.3	−.9	2 stations	95	29	Decorah	26	16	4.70	+.67	Sheldon	9.00	Sioux City	1.62
Kansas	63.2	−.8	Hill City	102	30	Burr Oak	28	15	2.53	−1.27	Junction City	8.90	Sharon Springs	T
Kentucky	65.4	.0	Lovelaceville	95	28	Quicksand	32	10	3.62	−.28	Louisa	7.53	Beres	1.62
Louisiana	73.3	−.4	2 stations	96	[1] 28	Tallulah	44	9	4.56	−.03	Ruston	11.93	Cheneyville	1.10
Maryland-Delaware	66.4	+3.6	do	98	31	Oakland, Md	33	11	3.88	+.39	Unionville, Md	8.56	Pocomoke City, Md	.96
Michigan	55.0	+.7	do	96	[1] 29	Cadillac	16	10	4.32	+1.10	Traverse City	10.78	Detour	1.15
Minnesota	52.8	−2.5	do	87	[1] 28	Meadowlands	20	16	5.51	+2.28	St. Paul (Airport)	11.29	Mahnomen	.70
Mississippi	71.3	−.5	Clarksdale	98	29	Duck Hill	39	9	3.61	−.65	Biloxi	8.32	Corinth	.81
Missouri	63.8	−.7	Sikeston	97	28	Albany	29	4	5.31	+.62	Boonville	11.36	Caruthersville	1.25
Montana	49.3	−2.8	2 stations	89	[1] 23	Wisdom	7	10	3.76	+1.63	Sun River Canyon	8.00	Scobey	.94
Nebraska	57.3	−2.1	do	99	[1] 26	2 stations	21	[1] 6	4.25	+.85	Fort Robinson	11.39	Stratton	1.44
Nevada	52.8	−3.0	Overton	107	21	Sheldon	7	1	.92	+.06	Jarbridge	4.10	10 stations	.00
New England	58.5	+3.3	New London, Conn.	94	30	West Cummington, Mass.	20	11	2.98	−.35	Mays Mill, Vt	6.87	Middleboro, Mass	1.17
North Jersey	64.3	+3.9	North Marchantville.	97	30	Layton	25	11	2.41	−1.27	Belvidere	5.30	Barnegat City	.96
New Mexico	58.9	−.7	Carlsbad	103	[1] 26	Selsor Ranch	14	1	.27	−.97	Dawson	2.39	65 stations	.00
New York	59.7	+3.6	5 stations	92	[1] 13	Indian Lake	22	11	4.03	+.61	Delhi	8.28	Ticonderoga	1.27
North Carolina	68.0	+1.1	Mount Airy	92	31	Mount Mitchell	27	9	5.21	+1.18	Pisgah Forest	13.94	Newbern	.98
North Dakota	50.0	−3.6	Milnor	87	24	Dunseith	19	4	3.03	+.71	Forman	6.90	Kenmare	.93
Ohio	62.5	+1.9	2 stations	95	1	2 stations	30	[1] 5	3.96	+.30	Warren No. 1	7.63	Montpelier	1.97
Oklahoma	67.5	−.9	do	100	[1] 26	4 stations	32	15	2.21	−2.44	Idabel	8.20	Fairview	.14
Oregon	50.6	−2.7	do	94	[1] 20	Chemult	12	1	3.27	+1.52	Brookings	9.41	Arlington	.59
Pennsylvania	62.5	+2.8	Marcus Hook	99	30	Coudersport	22	11	5.62	+1.78	Lansford	11.72	2 stations	1.59
South Carolina	71.0	+.1	2 stations	95	[1] 5	Caesars Head	39	[1] 8	4.46	+.95	Caesars Head	12.02	Lake City	1.68
South Dakota	52.7	−3.8	Wagner	95	29	Ralph	22	[1] 3	5.86	+3.00	Wentworth	11.86	Camp Crook	1.91
Tennessee	67.7	+.8	Tiptonville	98	29	Waynesboro	33	8	3.20	−.89	Tellico Plains	7.36	Dresden	.52
Texas	72.6	−.4	Fort Stockton	106	[1] 26	Pampa	32	15	2.65	−.99	Centerville	9.06	2 stations	T
Utah	52.1	−3.4	St. George	99	21	Kimberly	11	17	1.28	+.08	Rice Canyon	6.72	4 stations	.00
Virginia	67.0	+2.8	2 stations	98	[1] 1	Burkes Garden	29	10	4.97	+1.29	Floyd	12.62	Capron	.80
Washington	54.5	−1.1	Mottinger	94	21	Paradise Ranger Station.	20	1	2.94	+1.00	Carbon River Entrance.	9.09	White Swan	.34
West Virginia	63.5	+1.8	Hinton	98	1	Terra Alta	27	26	4.61	+.66	Spruce Knob	8.49	Ravenswood	2.64
Wisconsin	54.2	−1.1	4 stations	91	[1] 29	4 stations	23	10	6.37	+1.72	Marshfield	11.02	Plum Island	3.05
Wyoming	47.0	−2.6	Clarmont	92	26	Marshall (near)	1	6	2.97	+.95	Kirtley (near)	7.17	Eden	.45
Alaska [April]	33.1	+5.9	View Cove	67	[1] 3	Point Lay	20	[1] 16	1.65	+.15	Baranof	15.75	Barrow	.03
Hawaii	73.0	+.8	Kanehohe	92	27	Volcano Observatory.	46	[1] 1	5.08	−1.50	Honomaele Mauka	34.13	4 stations	.00
Puerto Rico	77.8	+.9	Manati	96	19	2 stations	57	[1] 1	6.89	−.85	Lares	20.18	Coamo (near)	1.17

[1] Other dates also.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max.+mean min.÷2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch, or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month	Number of days with thunderstorms
	Ft.	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	°*F.*	°*F.*	°*F.*		°*F.*	°*F.*		°*F.*	°*F*	°*F.*	°*F.*	%	*In.*	*In.*		*Miles*								*0–10*	*In.*	*In.*	
New England							**56.9**	**+3.3**										**80**	**2.27**	**−0.9**										**6.6**			
Eastport	75	67	85	29.98	30.06	+0.10	48.7	+1.0	70	30	56	36	9	42	26	46	44	89	1.45	−1.6	15	8.1	s.	23	s.	3	6	7	18	7.1	0.0	0.0	2
Greenville, Maine	1,070	6	41	28.89	30.05	.....	53.3	+3.7	84	3	66	29	1	41	49	50	46	...	2.69	−.6	16	.....	se.	.....	.....	...	4	8	19	.....	.0	.0	4
Portland, Me.[1]	103	5	36	29.93	30.04	+.07	54.8	.....	85	30	64	32	11	46	36	50	47	79	1.77	−1.6	12	7.8	s.	25	s.	6	7	10	14	6.6	.0	.0	1
Concord [2]	289	54	72	29.72	30.03	+.05	58.8	+4.5	90	3	72	26	11	46	46	54	49	75	2.00	−1.0	12	6.4	nw.	23	nw.	30	6	11	14	6.3	.0	.0	5
Burlington [2]	403	11	48	29.56	29.99	+.02	59.2	+2.7	83	14	68	34	11	50	31	55	52	74	2.13	−.7	13	9.1	s.	35	s.	16	1	15	15	7.2	.0	.0	8
Northfield	876	12	60	29.09	30.03	+.06	57.0	+4.2	82	3	69	27	11	45	42	...	...	...	1.93	−.8	12	7.8	s.	31	s.	16	0	16	15	7.7	.0	.0	2
Boston [1]	124	33	62	29.91	30.04	+.06	60.8	.....	88	30	70	44	8	52	36	54	49	73	2.11	−1.1	10	9.6	sw.	29	sw.	12	4	11	16	7.2	.0	.0	2
Nantucket	12	10	63	30.05	30.07	+.08	56.1	+3.8	72	26	62	41	2	50	22	53	51	91	2.11	−.7	8	10.5	sw.	27	sw.	30	7	13	11	6.1	.0	.0	3
Block Island	26	11	46	30.03	30.06	+.07	55.8	+3.0	74	30	62	42	2	50	19	52	51	88	1.73	−1.8	7	12.6	sw.	30	sw.	30	11	14	6	4.6	.0	.0	3
Providence [1]	159	46	60	29.89	30.06	+.08	62.0	+3.5	89	30	71	41	11	53	27	54	50	78	1.77	−1.2	10	8.0	se.	23	sw.	24	4	13	14	6.8	.0	.0	2
Hartford [1]	159	5	44	29.87	30.04	+.06	62.2	.....	89	30	72	35	11	52	31	56	52	77	3.89	+.3	11	8.7	sw.	26	s.	12	4	8	19	7.3	.0	.0	4
New Haven [2]	107	74	153	29.94	30.06	+.07	61.2	+3.3	88	30	69	40	11	54	27	55	52	81	3.67	.0	10	7.8	s.	21	s.	13	7	9	15	6.2	.0	.0	5
Middle Atlantic States							**66.3**	**+4.1**										**71**	**3.92**	**+0.5**									**5.7**			
Albany [1]	97	26	40	29.91	30.02	+.04	61.0	+3.3	87	3	72	34	11	50	35	55	51	72	2.46	−.1	12	9.8	s.	34	s.	12	4	13	14	7.0	.0	.0	4
Binghamton	871	57	79	29.11	30.03	+.05	61.2	+3.8	87	29	72	30	11	51	39	54	50	71	3.33	.0	14	5.8	se.	19	se.	15	1	9	21	8.0	.0	.0	8
New York	314	415	454	29.70	30.03	+.04	64.1	+3.5	89	30	72	48	11	56	25	56	51	69	1.84	−1.4	10	13.5	se.	36	s.	23	9	10	12	5.5	.0	.0	5
Harrisburg [1]	374	30	49	29.62	30.02	+.04	66.2	.....	97	1	77	37	11	55	40	58	53	69	6.39	+3.0	13	7.8	se.	31	se.	15	6	14	11	6.2	.0	.0	11
Philadelphia [2]	114	174	367	29.92	30.04	+.05	67.2	+4.3	93	30	77	48	11	57	32	59	54	68	1.82	−1.4	6	12.2	s.	34	se.	22	9	13	9	5.2	.0	.0	5
Reading	323	47	306	29.69	30.04	.....	66.0	+4.0	93	30	76	41	11	56	34	...	...	...	9.29	+5.6	11	10.7	se.	33	s.	15	9	15	7	5.4	.0	.0	7
Scranton	805	72	104	29.18	30.03	+.05	63.0	+3.6	89	30	73	33	11	53	37	...	...	...	6.73	+3.5	11	6.5	sw.	27	se.	16	7	14	10	5.8	.0	.0	8
Atlantic City	52	37	172	29.99	30.04	+.06	62.4	+4.3	90	31	69	48	11	56	30	57	54	80	1.45	−1.6	7	15.1	s.	33	se.	16	10	12	9	5.3	.0	.0	5
Trenton	190	89	107	29.84	30.04	.....	65.8	+4.7	94	30	76	43	11	55	34	58	52	68	1.95	−1.1	7	8.8	s.	26	se.	22	8	13	10	5.6	.0	.0	5
Baltimore [2]	123	100	215	29.90	30.03	+.04	69.0	+4.6	94	31	78	50	11	60	28	60	55	67	4.19	+.6	8	10.7	s.	34	se.	15	8	13	10	5.6	.0	.0	7
Washington [1]	112	62	85	29.96	30.03	+.03	69.1	+5.4	96	1	79	48	11	60	34	60	55	68	3.93	+.2	6	7.2	se.	24	se.	15	9	15	7	5.1	.0	.0	5
Cape Henry	18	8	54	30.02	30.04	.....	68.6	+4.4	90	2	76	52	6	61	27	62	60	78	3.20	−.4	10	10.2	se.	34	n.	17	11	14	6	4.7	.0	.0	6
Lynchburg	686	144	184	29.31	30.04	+.04	69.4	+2.1	95	31	80	47	10	58	35	60	56	67	6.02	+2.4	9	7.0	nw.	25	se.	15	10	10	11	5.6	.0	.0	9
Norfolk [2]	91	80	125	29.95	30.05	+.05	70.9	+4.7	95	31	80	54	10	62	30	62	59	76	2.70	−1.1	9	9.5	sw.	31	nw.	7	9	14	8	5.3	.0	.0	7
Richmond [2]	144	11	52	29.88	30.03	+.04	70.7	+4.2	95	1	82	51	8	60	31	62	58	72	3.57	−.2	7	7.7	sw.	22	ne.	10	9	13	9	5.1	.0	.0	10
South Atlantic States							**71.3**	**+1.1**										**75**	**3.77**	**+0.3**									**5.4**			
Asheville	2,253	89	104	27.74	30.05	+.06	63.9	+1.3	87	2	75	38	9	53	41	56	53	77	4.63	+1.2	14	7.1	nw.	26	nw.	24	7	9	15	6.6	.0	.0	10
Charlotte [2]	779	63	86	29.22	30.04	+.05	70.5	+1.6	90	30	80	51	25	61	29	62	58	75	6.58	+3.0	10	6.3	s.	22	s.	15	6	13	12	6.2	.0	.0	7
Greensboro [1]	886	6	56	29.12	30.05	.....	67.7	.....	90	31	79	42	10	57	36	60	57	73	4.71	.....	10	7.7	s.	26	se.	15	7	11	13	6.5	.0	.0	7
Hatteras	11	5	50	30.05	30.06	+.05	71.2	+2.5	81	30	77	57	9	65	19	66	63	79	1.17	−2.5	7	11.5	sw.	30	w.	23	10	14	7	4.9	.0	.0	3
Raleigh [1]	376	27	69	29.65	30.05	+.06	70.2	+1.9	92	31	81	46	10	59	36	62	59	74	3.36	−.4	11	8.3	s.	24	sw.	7	9	9	13	5.8	.0	.0	7
Wilmington	72	73	107	29.98	30.05	+.04	71.3	+.5	84	5	79	52	10	64	25	65	62	77	6.03	+2.6	12	9.3	se.	27	nw.	23	16	8	7	4.5	.0	.0	5
Charleston [2]	48	11	92	29.99	30.04	+.03	73.2	+.5	85	5	80	58	10	66	22	66	64	81	2.70	−.3	7	9.7	s.	31	se.	15	18	5	8	4.2	.0	.0	2
Columbia, S. C.[2]	347	70	91	29.66	30.03	+.03	72.3	+.4	90	5	82	51	10	62	32	65	62	74	4.57	+1.5	9	7.5	s.	26	s.	15	12	5	14	5.6	.0	.0	9
Greenville, S. C.[1]	1,040	70	78	28.95	30.04	.....	69.0	+1.8	89	2	79	50	9	59	29	60	56	69	4.02	.0	9	7.5	sw.	24	n.	23	7	12	12	6.4	.0	.0	9
Augusta [2]	182	62	77	29.84	30.03	+.04	72.8	+.4	90	2	83	51	10	63	29	63	58	69	5.64	+2.6	8	5.1	se.	21	nw.	21	13	9	9	5.1	.0	.0	6
Savannah [2]	65	73	152	29.98	30.04	+.04	74.7	+1.3	90	7	84	55	9	66	29	66	63	75	1.71	−1.3	8	9.0	s.	27	n.	21	14	9	8	4.7	.0	.0	3
Jacksonville [2]	43	86	110	29.99	30.04	+.04	75.4	+.4	88	27	84	57	9	67	22	67	64	75	1.04	−3.0	6	6.9	e.	24	s.	15	12	13	6	4.6	.0	.0	8
Florida Peninsula							**78.6**	**+1.3**										**75**	**1.35**	**−2.9**									**4.3**			
Key West [2]	21	10	64	29.97	29.99	+.02	79.9	+.8	88	26	85	70	29	74	18	73	71	75	1.07	−2.5	7	8.6	e.	24	se.	29	19	7	5	3.6	.0	.0	4
Miami [2]	25	124	168	29.97	30.00	+.01	78.3	+1.9	88	24	83	68	21	74	18	70	67	74	1.74	−4.5	9	8.6	e.	20	s.	16	10	12	9	5.4	.0	.0	8
Tampa [1]	35	5	61	29.98	30.02	+.03	77.6	+1.3	92	18	87	61	10	68	27	69	66	75	1.23	−1.8	6	9.1	e.	32	ne.	31	16	13	2	4.0	.0	.0	5
East Gulf States							**72.5**	**−0.3**										**73**	**5.21**	**+1.4**									**4.9**			
Atlanta [1]	1,173	5	72	28.81	30.02	+.03	69.9	.....	90	2	80	45	9	60	30	61	57	70	5.29	+1.9	10	8.0	nw.	32	sw.	27	8	11	12	5.7	.0	.0	7
Macon [2]	370	79	87	29.63	30.02	+.03	71.8	−.5	90	2	83	47	9	61	36	63	58	69	4.23	+1.3	7	6.1	s.	22	nw.	20	6	15	10	5.4	.0	.0	7
Thomasville	273	49	58	29.76	30.05	+.06	74.0	.0	90	2	85	51	9	63	30	...	...	...	7.56	+3.9	9	.....	.....	.....	.....	...	4	11	16	.....	.0	.0	10
Apalachicola	35	11	51	29.98	30.02	.....	73.6	−1.0	86	28	81	57	9	66	22	68	66	80	4.86	+1.5	6	7.7	s.	32	s.	15	14	10	7	4.2	.0	.0	6
Pensacola	56	54	79	29.97	30.03	+.04	73.0	−.9	88	28	81	54	9	65	24	66	63	75	5.73	+2.4	8	6.8	sw.	28	sw.	14	17	8	6	3.9	.0	.0	6
Anniston	...	...	...	70.2	+1.8	.....	93	1	82	42	9	58	40	.....	.....	.....	.....	...	5.97	+2.1	9	.....	se.	.....	.....	...	5	21	5	.....	.0	.0	6
Birmingham [2]	700	11	48	29.30	30.03	+.05	70.7	−.4	89	1	81	46	9	60	34	62	57	67	3.95	.0	5	6.2	s.	16	se.	2	11	11	9	4.9	.0	.0	4
Mobile [2]	57	6	30	29.96	30.02	+.03	73.4	−1.0	93	28	83	53	9	64	29	66	62	76	6.36	+2.0	6	8.1	s.	32	se.	13	8	14	9	5.2	.0	.0	6
Montgomery [2]	218	92	105	29.79	30.02	+.03	72.8	−.6	92	28	83	52	9	63	27	63	58	68	4.03	+.2	6	6.3	e.	18	w.	21	11	15	5	4.8	.0	.0	6
Meridian [2]	375	67	92	29.62	30.02	+.04	71.0	−.3	91	29	82	46	9	60	36	63	58	70	3.06	−1.3	6	5.6	e.	23	nw.	14	17	7	7	3.7	.0	.0	5
Vicksburg [1]	247	82	102	29.74	30.00	+.03	71.7	−1.2	94	29	81	52	8	62	25	63	61	81	5.15	+.8	8	7.5	se.	38	w.	14	4	16	11	5.9	.0	.0	8
New Orleans [1]	53	76	84	29.96	30.01	+.04	75.7	+.3	90	28	84	58	8	68	23	68	65	75	6.35	+1.8	7	6.2	se.	18	e.	15	10	14	7	5.0	.0	.0	6
West Gulf States							**73.0**	**−0.2**										**77**	**3.18**	**−1.0**									**6.0**			
Shreveport [1]	249	92	227	29.71	29.98	+.03	72.6	.0	95	31	82	52	8	63	27	65	61	74	8.00	+3.8	6	9.8	s.	33	se.	18	10	9	12	5.6	.0	.0	6
Bentonville	1,303	12	51	28.63	29.99	+.06	63.8	−2.6	88	31	74	38	4	53	34	...	...	...	2.28	−2.9	10	7.5	s.	25	s.	17	13	15	3	5.0	.0	.0	9
Fort Smith	463	57	82	.....	29.94	+.01	68.8	−.8	94	30	78	45	4	59	.....	...	...	...	5.01	+.2	9	7.6	e.	29	se.	17	8	15	8	.....	.0	.0	8
Little Rock [2]	357	94	102	29.61	29.98	+.03	68.8	−1.5	91	31	79	48	16	58	29	63	59	74	3.76	−1.0	9	8.1	s.	23	w.	21	9	16	6	5.6	.0	.0	10
Austin [2]	605	68	90	29.30	29.93	.....	74.4	−.2	93	29	83	50	15	65	28	67	64	78	2.05	−2.6	8	9.8	s.	41	ne.	19	6	16	9	6.0	.0	.0	7
Brownsville [2]	57	88	96	29.83	29.88	.....	79.1	+.5	91	14	86	63	16	72	20	73	71	82	1.67	−.6	2	12.6	se.	27	se.	2	4	13	14	6.9	.0	.0	2
Corpus Christi [2]	20	11	78	29.90	29.92	+.02	77.4	+1.2	89	27	82	61	15	72	22	71	70	85	1.93	−1.3	7	12.5	s.	31	e.	18	5	11	15	6.4	.0	.0	4
Dallas [1]	512	6	46	29.40	29.94	.....	72.2	.....	94	29	82	45	15	62	32	65	61	73	4.57	+.1	7	13.2	s.	41	se.	13	6	11	14	6.4	.0	.0	6
Fort Worth [1]	679	35	56	29.22	29.93	+.02	72.6	+.4	94	29	83	45	15	62	34	65	61	72	2.85	−1.8	8	13.3	s.	44	s.	10	5	14	12	6.2	.0	.0	8
Galveston [2]	54	106	114	29.91	29.96	+.02	75.1	+.3	84	28	79	61	15	71	16	70	68	81	.35	−3.1	4	11.8	se.	25	e.	18	8	17	6	5.2	.0	.0	3
Houston [2]	138	157	190	29.82	29.96	.....	75.4	−.1	90	29	84	54	15	67	25	68	66	80	1.09	−3.4	8	11.1	se.	33	e.	18	8	11	12	5.9	.0	.0	2
Palestine	510	64	72	29.44	29.97	+.04	72.0	−.7	90	28	81	48	15	63	29	65	62	76	7.48	+2.9	10	7.9	s.	23	nw.	14	9	10	12	5.9	.0	.0	9
Port Arthur	34	59	134	29.94	29.98	.....	75.4	.....	89	30	82	56	8	69	22	69	66	77	1.26	−2.9	3	13.5	s.	38	sw.	12	7	15	9	5.5	.0	.0	6
San Antonio [1]	693	28	59	29.20	29.91	+.01	76.0	+.9	93	29	85	54	15	67	28	69	66	76	2.19	−1.0	8	9.4	se.	31	w.	19	3	14	14	6.9	.0	.0	5

See footnotes at end of table.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS—Continued

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max.+mean min.÷2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month	Number of days with thunderstorms
Ohio Valley and Tennessee	*Ft.*	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	°F.	°F.	°F.		°F.	°F.		°F.	°F.	°F.	°F.	%	*In.*	*In.*		*Miles*								*0–10*	*In.*	*In.*	
							64.8	+0.8										72	3.95	+0.2										6.4			
Chattanooga [1]	762	21	54	29.22	30.02	+.03	68.5	-----	92	2	81	41	10	56	40	61	56	70	4.15	-----	9	6.0	s.	33	w.	19	8	9	14	6.2	.0	.0	8
Knoxville [2]	995	66	84	28.99	30.03	+.04	67.8	+.6	89	2	80	43	9	56	35	59	54	69	5.20	+1.4	14	6.6	ne.	29	w.	20	9	13	9	5.6	.0	.0	9
Memphis [2]	399	78	86	29.58	29.99	+.03	69.3	−1.3	92	29	80	46	8	59	31	62	58	72	2.33	−1.9	8	7.8	s.	22	sw.	1	11	10	10	5.0	.0	.0	9
Nashville [1]	546	5	72	29.43	30.01	+.03	68.4	-----	91	28	80	42	9	57	42	60	55	66	2.39	−1.5	8	7.9	s.	26	nw.	15	10	8	13	5.7	.0	.0	7
Lexington	989	6	----	28.97	30.04	+.05	64.6	+.3	91	31	76	40	9	53	34	----	----	----	3.38	−.4	15	----	s.	----	----	----	9	13	9	5.7	.0	.0	7
Louisville [2]	525	106	120	29.45	30.01	+.03	65.5	−1.1	89	31	75	44	5	56	30	58	54	72	3.43	−.3	10	8.7	sw.	29	sw.	3	9	10	12	5.9	.0	.0	2
Evansville [1]	431	5	38	29.54	29.99	+.02	64.8	-----	89	29	75	42	5	55	29	58	54	69	5.19	+1.3	8	8.3	s.	30	w.	3	7	12	12	6.3	.0	.0	6
Indianapolis [2]	823	98	129	29.12	29.99	+.02	64.4	+1.5	91	29	74	41	16	55	31	56	53	77	5.57	+1.7	13	8.2	s.	27	sw.	3	1	11	19	7.8	.0	.0	7
Terre Haute [2]	575	68	149	29.38	30.00	-----	64.6	-----	91	29	74	41	5	55	27	57	53	74	5.02	+1.2	15	9.9	s.	33	nw.	13	2	19	10	6.7	.0	.0	12
Cincinnati [2]	627	11	51	29.34	30.01	+.02	64.4	+1.3	90	31	74	39	5	54	29	58	54	74	3.92	+.2	12	7.1	s.	22	w.	6	5	9	17	6.9	.0	.0	7
Columbus [2]	822	90	110	29.15	30.01	+.03	64.2	+1.9	92	30	73	42	5	55	31	56	53	73	3.41	−.2	10	9.3	s.	41	sw.	3	7	5	19	7.0	.0	.0	5
Dayton [2]	900	186	213	29.05	30.01	-----	63.8	+1.2	90	29	73	40	5	55	27	56	52	75	2.31	−1.3	11	10.3	sw.	35	s.	3	2	12	17	7.5	.0	.0	6
Elkins [2]	1,947	61	78	28.02	30.04	+.04	61.6	+2.4	88	3	73	39	26	50	39	55	51	76	4.90	+.8	14	5.7	nw.	24	w.	3	3	11	17	7.2	.0	.0	5
Parkersburg	637	77	84	29.34	30.02	+.03	64.4	+.6	93	1	75	41	17	54	36	58	54	73	3.87	+.5	12	5.1	se.	30	sw.	12	7	14	10	5.9	.0	.0	9
Pittsburgh [1]	842	39	54	29.12	30.01	+.02	63.0	+1.8	93	1	73	41	11	52	35	56	51	73	4.41	+1.2	17	9.7	s.	29	sw.	12	2	13	16	7.2	.0	.0	8
Lower Lake Region							59.7	+2.6										74	3.67	+0.4										6.9			
Buffalo [2]	768	243	280	29.18	30.00	+.03	56.4	+1.8	81	14	64	35	10	49	33	52	48	74	3.75	+.6	17	14.7	sw.	52	sw.	30	3	11	17	7.3	.0	.0	5
Canton	448	10	61	29.51	29.98	-----	58.9	+2.7	87	14	69	35	10	49	37	54	49	73	2.06	−.9	14	8.6	sw.	25	sw.	4	2	12	17	7.4	.0	.0	5
Ithaca	836	77	100	----	----	----	58.2	+2.7	88	1	70	30	11	50	40	----	----	----	3.31	−.1	14	8.4	nw.	43	s.	3	2	11	18	7.5	.0	.0	8
Oswego	335	71	85	29.64	30.00	+.03	57.4	+2.2	86	29	66	36	11	49	30	53	49	76	3.98	+.9	18	7.9	s.	26	se.	16	4	12	15	6.6	.0	.0	4
Rochester [1]	523	5	69	29.44	30.00	+.03	59.8	-----	90	14	70	34	11	50	42	54	50	73	3.51	+.6	19	9.0	sw.	33	sw.	23	2	10	19	7.4	.0	.0	6
Syracuse [1]	596	5	51	29.37	30.01	+.03	60.0	+3.7	87	29	70	30	11	50	40	55	52	76	3.71	+.7	16	8.9	s.	34	sw.	3	4	8	19	7.4	.0	.0	7
Erie [2]	714	57	81	29.24	30.01	+.03	60.1	+3.3	87	29	68	39	11	53	25	54	51	79	6.47	+3.1	17	8.1	w.	24	w.	14	3	19	9	6.1	.0	.0	6
Cleveland [1]	762	27	54	29.18	30.00	+.02	62.0	-----	89	29	72	39	11	52	34	54	50	70	3.70	+.6	13	10.4	s.	37	sw.	3	3	11	17	6.9	.0	.0	9
Sandusky	629	5	67	----	----	----	62.2	+3.0	93	30	71	42	11	54	27	----	----	----	3.81	+.7	14	8.6	sw.	24	nw.	15	5	9	17	6.9	.0	.0	7
Toledo [2]	628	79	87	29.31	29.99	+.02	61.4	+2.0	92	29	70	40	5	53	29	55	51	74	2.51	−1.0	11	9.8	w.	28	nw.	31	14	8	9	5.1	.0	.0	5
Fort Wayne [1]	857	69	84	29.07	29.98	-----	60.8	+1.6	93	29	72	34	5	50	33	55	51	72	2.73	−1.1	13	9.3	sw.	31	s.	1	3	10	18	7.2	.0	.0	8
Detroit [1]	730	215	78	29.21	30.00	+.03	59.5	-----	93	30	69	36	10	50	33	53	49	72	4.51	+1.3	17	9.6	s.	45	nw.	29	3	8	20	7.5	.0	.0	9
Upper Lake Region							53.5	+0.9										75	4.44	+1.2										7.0			
Alpena	609	5	89	29.31	29.98	+.01	51.8	+1.3	79	14	60	32	10	44	35	48	44	77	3.23	+.2	17	11.2	se.	31	e.	11	3	11	17	7.5	.0	.0	4
Escanaba	612	54	60	----	29.98	+.01	50.0	+.4	72	8	58	32	5	42	----	----	----	74	2.94	-.0	17	11.4	s.	29	nw.	3	5	11	15	----	T	.0	5
Grand Rapids [2]	707	70	244	29.19	29.95	−.02	59.8	+1.8	90	30	69	39	5	50	31	53	50	77	5.76	+2.3	15	11.2	sw.	49	n.	29	6	9	16	6.5	.0	.0	10
Lansing [2]	878	5	90	29.04	29.98	-----	58.0	+1.1	87	30	68	36	10	48	31	53	48	73	5.25	+1.8	13	8.3	s.	40	nw.	29	6	9	16	6.9	.0	.0	5
Marquette	734	44	73	29.17	29.98	+.01	49.4	+.4	86	28	59	31	5	40	40	44	39	71	3.90	+.9	15	8.0	nw.	33	sw.	1	6	10	15	7.0	T	.0	3
Sault Sainte Marie [2]	614	11	52	29.31	29.98	+.03	49.1	+.1	76	1	60	29	6	38	41	45	41	78	2.46	−.2	12	11.2	se.	47	sw.	3	3	12	16	6.9	T	.0	3
Chicago	673	7	131	29.25	29.98	+.02	59.5	+2.0	95	29	69	39	15	50	34	53	48	72	4.50	+1.0	18	10.4	sw.	33	sw.	11	3	9	19	7.6	.0	.0	9
Green Bay	617	109	141	29.29	29.96	+.01	54.2	−.7	78	25	63	37	15	46	29	50	46	75	7.10	+3.6	15	11.3	s.	32	ne.	6	6	8	17	6.9	.0	.0	5
Milwaukee [1]	681	33	66	29.23	29.96	.00	55.0	+2.4	88	30	65	36	15	45	36	49	45	75	4.49	+1.1	18	12.7	n.	44	sw.	13	3	9	17	7.2	.0	.0	7
Duluth	1,133	5	47	28.74	29.98	+.02	47.8	+.5	82	28	57	25	16	39	35	43	38	74	4.74	+1.5	15	11.7	ne.	37	w.	8	6	10	15	6.7	T	.0	5
North Dakota							50.6	−3.0										69	2.44	+0.1										6.9			
Fargo [1]	940	5	43	28.93	29.95	+.01	52.0	−3.1	85	28	62	30	5	42	35	47	42	72	2.19	−.7	12	13.5	n.	41	n.	13	8	4	19	7.2	T	.0	7
Bismarck [1]	1,677	4	41	28.18	29.97	+.05	50.6	−2.4	84	28	62	27	14	39	36	45	40	71	3.04	+.7	15	13.5	ne.	37	n.	13	7	8	16	6.9	3.3	.0	4
Devils Lake	1,478	11	44	28.40	29.98	+.04	49.0	−3.6	78	24	59	27	14	39	35	43	37	69	3.01	+1.0	13	11.2	ne.	30	n.	13	5	3	23	7.9	T	.0	1
Lemmon, S. Dak	2,602	4	38	27.22	29.96	-----	48.8	-----	80	24	59	26	3	39	37	44	40	---	3.23	------	11	------	ne.	----	----	----	6	5	20	----	8.0	.0	5
Grand Forks	832	11	71	29.07	29.98	-----	50.4	-----	82	28	61	29	5	39	36	45	40	---	2.07	------	10	------	ne.	----	----	----	5	8	18	----	T	.0	2
Williston	1,878	42	50	27.99	29.98	+.05	51.0	−3.0	85	24	61	27	3	41	34	44	37	65	1.53	−.5	10	8.2	ne.	27	w.	24	10	10	11	5.5	.0	.0	3
Upper Mississippi Valley							61.2	−0.7										73	4.74	+0.6										6.8			
Minneapolis-St. Paul, Minn. [1]	919	32	61	28.94	29.92	−.02	56.0	-----	85	28	65	36	15	47	32	50	44	69	6.78	+3.1	15	10.6	se.	42	nw.	29	5	8	18	7.4	.0	.0	8
Springfield, Minn	1,025	4	42	28.82	29.92	-----	55.6	-----	87	28	65	32	3	46	39	50	45	---	5.44	------	14	------	nw.	----	----	----	5	5	21	----	.0	.0	7
La Crosse [2]	714	11	48	29.16	29.93	−.01	57.2	−2.1	82	28	66	35	16	48	32	51	47	73	5.92	+2.2	14	4.8	w.	22	s.	1	4	6	21	7.5	.0	.0	7
Madison [2]	974	70	78	28.91	29.96	.00	56.8	−.8	88	29	66	35	15	48	29	51	48	78	4.03	+.2	18	8.1	se.	31	ne.	29	2	7	22	7.7	T	.0	8
Charles City	1,015	10	51	28.86	29.94	.00	56.8	−1.0	89	29	66	33	16	47	33	52	47	72	5.51	+1.2	12	6.9	se.	27	s.	1	8	10	13	6.3	.0	.0	5
Davenport [2]	606	66	161	29.31	29.97	+.02	61.6	+.3	90	30	71	39	16	52	30	54	50	72	3.65	−.3	12	10.1	sw.	31	sw.	1	1	8	22	7.8	.0	.0	10
Des Moines [2]	860	5	99	28.99	29.91	−.02	61.0	−.3	91	28	70	37	4	52	29	54	50	73	6.62	+2.1	10	10.3	sw.	34	se.	5	5	14	12	6.3	.0	.0	9
Dubuque	699	60	79	29.20	29.94	−.01	59.4	−.9	90	29	69	37	16	50	31	53	49	72	5.89	+1.7	16	6.2	nw.	21	s.	1	5	6	20	7.6	.0	.0	11
Burlington, Ia.	702	6	35	29.20	29.94	.00	61.2	−2.4	90	29	71	35	16	51	34	54	50	72	3.51	−.6	13	9.9	s.	39	sw.	1	2	12	17	7.3	.0	.0	9
Cairo	358	87	93	29.62	29.99	+.03	67.4	−1.0	92	28	77	47	5	58	28	----	----	----	3.21	−.5	7	8.3	s.	25	ne.	19	6	9	16	6.5	.0	.0	6
Peoria [2]	609	11	45	29.31	29.96	.00	61.9	+.2	93	29	72	38	16	52	33	55	52	74	3.28	−.8	12	5.8	s.	24	sw.	1	13	13	5	4.2	.0	.0	8
Springfield, Ill. [2]	636	51	191	29.29	29.97	+.02	64.5	+1.3	94	29	74	42	16	55	27	56	53	75	3.43	−1.2	11	11.4	s.	43	sw.	13	1	13	17	7.4	.0	.0	12
St. Louis [1]	568	179	303	29.37	29.97	+.02	65.6	−1.4	92	30	74	45	4	57	25	57	52	67	4.99	+.6	12	12.8	sw.	13	sw.	2	9	13	9	5.1	.0	.0	9
Missouri Valley							59.2	−1.7										74	4.97	+0.8										6.3			
Columbia, Mo [2]	784	6	66	29.12	29.95	+.01	64.0	−.3	91	30	74	38	4	54	30	56	52	73	4.84	+.4	15	7.7	s.	21	nw.	13	5	20	6	5.7	.0	.0	11
Kansas City [1]	963	38	76	28.90	29.92	.00	64.2	-----	91	28	73	36	4	55	28	57	52	69	3.68	−1.0	12	11.5	sw.	32	sw.	1	9	10	12	5.9	.0	.0	8
St. Joseph [2]	967	11	49	28.89	29.92	------	62.5	−1.7	90	28	72	33	4	53	29	57	54	81	7.00	+2.3	10	9.0	s.	27	nw.	6	9	10	12	5.9	.0	.0	9
Springfield, Mo. [1]	1,324	5	60	28.57	29.96	+.03	62.4	-----	88	31	72	33	4	52	33	57	54	76	2.72	−2.5	10	11.5	se.	34	sw.	1	8	12	11	6.1	.0	.0	7
Topeka	987	65	87	28.87	29.92	-----	63.7	-----	91	28	74	37	4	54	30	56	51	69	5.29	+.8	13	9.5	s.	26	w.	2	6	13	12	6.2	.0	.0	7
Lincoln [2]	1,189	11	81	28.64	29.89	−.02	60.8	−.9	91	29	71	35	4	50	30	54	51	77	4.59	+.5	14	10.2	s.	32	sw.	13	8	10	13	6.5	.0	.0	11
Omaha [1]	1,105	31	44	28.73	29.90	−.02	60.8	−1.6	92	29	71	35	4	51	32	54	50	72	3.93	+.2	13	12.8	se.	40	se.	5	8	9	14	6.1	.0	.0	10
Valentine	2,598	46	54	27.20	29.91	+.01	52.7	−3.5	87	26	63	30	18	42	42	47	43	76	5.59	+2.8	12	10.8	n.	30	s.	24	4	11	16	7.0	5.5	.0	8
Sioux City [1]	1,138	5	27	28.70	29.90	−.02	58.4	-----	94	29	70	29	4	47	36	52	47	71	1.62	------	10	11.7	e.	36	s.	13	5	8	18	6.9	.0	.0	6
Huron [1]	1,306	5	41	28.53	29.92	.00	54.4	−2.0	86	28	64	33	4	45	34	49	46	78	7.11	+4.1	14	14.7	se.	53	nw.	29	7	5	19	7.0	.0	.0	7
Northern Slope							51.6	−2.0										68	3.48	+1.1										6.7			
Billings [1]	3,570	18	39	26.26	29.92	-----	51.7	-----	80	23	62	32	16	42	32	45	39	69	4.93	------	14	10.9	sw.	38	nw.	26	3	14	14	6.9	T	.0	8
Havre	2,507	11	67	27.31	29.94	+.04	52.5	−.9	88	22	65	26	16	40	42	44	36	59	1.68	−.4	11	8.6	e.	26	se.	9	4	12	15	6.7	.0	.0	4
Helena [1]	4,124	5	35	25.75	29.96	+.03	48.6	−3.0	82	22	60	26	3	37	38	42	36	66	2.35	+.1	12	9.5	w.	45	s.	9	2	8	21	7.8	2.8	.0	5
Missoula [2]	3,205	80	91	26.59	29.97	-----	51.6	−1.2	84	22	63	30	3	40	38	43	38	71	3.77	+1.8	19	6.4	e.	36	ne.	22	3	9	19	7.5	.8	.0	4
Kalispell	2,973	48	56	26.88	29.93	+.05	50.4	−1.0	80	22	60	30	4	40	33	44	38	69	3.92	+2.5	19	6.3	w.	20	sw.	10	2	9	20	7.6	T	.0	
Miles City [2]	2,371	48	55	27.45	29.94	+.03	53.4	−3.3	80	23	64	32	3	43	35	46	41	71	2.83	+.6	12	6.9	ne.	26	nw.	26	8	7	16	6.5	.0	.0	4
Rapid City [2]	3,259	50	58	26.57	29.93	+.03	51.0	−3.0	85	24	60	30	5	42	39	45	41	75	4.78	+1.2	16	8.4	n.	25	nw.	27	6	10	15	6.6	8.0	.0	
Cheyenne [1]	6,094	5	39	23.94	29.88	+.03	48.7	-----	84	26	62	24	17	35	37	40	34	66	3.27	+.8	11	10.8	nw.	37	nw.	13	4	14	13	6.6	18.5	.0	6
Lander	5,352	60	68	24.58	29.87	−.01	49.7	−1.5	85	25	62	26	6	38	38	41	33	59	4.24	+2.0	11	6.1	sw.	30	sw.	11	5	13	13	6.6	23.0	.0	4
Sheridan [2]	3,790	6	42	26.04	29.92	-----	49.7	−2.5	80	26	61	26	18	39	38	44	39	72	4.28	+1.6	16	8.2	nw.	38	nw.	26	2	13	16	7.1	2.4	.0	9
North Platte [2]	2,821	11	51	26.96	29.86	−.02	57.2	−1.5	91	29	69	33	7	46	39	50	45	71	3.70	+.9	10	9.2	se.	30	nw.	5	13	12	6	4.2	T	.0	8

See footnotes at end of table.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS—Continued

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max.+mean min.÷2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month	Number of days with thunderstorms
	Ft.	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	°*F.*	°*F.*	°*F.*		°*F.*	°*F.*		°*F.*	°*F.*	°*F.*	°*F.*	%	*In.*	*In.*		*Miles*								*0–10*	*In.*	*In.*	
Middle Slope							**62.6**	**−0.4**										**61**	**1.46**	**−1.9**										**4.9**			
Denver [1]	5,292	106	113	24.65	29.83	−.01	66.2	+1.0	95	26	69	32	17	44	36	44	35	53	1.00	−1.2	5	7.8	ne.	29	ne.	13	8	16	7	5.2	T	.0	2
Pueblo [1]	4,690	5	30	25.18	29.79	−.04	59.9	.....	96	26	76	31	6	44	45	46	34	49	.92	−.7	8	10.6	e.	46	w.	12	13	15	3	4.3	T	.0	3
Concordia	1,392	50	58	28.44	29.90	−.01	62.0	−1.2	90	29	72	37	15	51	31	55	49	66	3.53	−.6	9	9.1	s.	26	nw.	5	6	17	8	5.6	.0	.0	10
Dodge City	2,509	10	86	27.29	29.85	−.02	63.1	−.4	99	27	77	35	6	50	39	53	47	62	1.22	−1.7	6	13.8	s.	36	s.	10	12	13	6	4.6	.0	.0	6
Wichita [1]	1,358	6	64	28.49	29.90	.00	63.6	−1.5	92	31	75	38	15	52	33	56	52	70	1.67	−2.8	7	16.3	s.	40	s.	16	10	12	9	5.3	.0	.0	5
Oklahoma City [2]	1,214	10	47	28.65	29.91	+.02	68.0	+.3	91	28	79	39	15	57	33	59	53	64	.43	−4.4	6	10.9	s.	25	s.	2	14	10	7	4.3	.0	.0	2
Southern Slope							**70.0**	**− .**										**60**	**2.70**	**0.0**										**4.6**			
Abilene [2]	1,738	10	56	28.11	29.88	+.01	71.9	−.1	93	12	83	44	15	61	35	62	56	68	5.54	+1.6	9	11.8	s.	30	nw.	18	8	15	8	5.1	.0	.0	8
Amarillo [3]	3,676	10	49	26.20	29.85	+.01	63.5	−.6	95	26	78	33	15	49	44	53	45	60	.91	−1.9	4	16.6	sw.	50	sw.	2	17	13	1	3.6	.0	.0	6
Del Rio	960	63	71	28.87	29.84	−.01	76.8	−.2	97	13	86	56	15	68	29	68	65	67	4.33	+1.4	6	10.6	se.	43	nw.	18	2	17	12	7.0	.0	.0	4
Roswell	3,566	75	85	26.28	29.83	+.01	67.7	−1.7	98	26	84	43	1	52	46	52	38	43	.01	−1.1	1	8.8	s.	26	s.	9	20	6	5	2.9	.0	.0	4
Southern Plateau							**70.4**	**+0.**										**28**	**T**	**−0.2**										**1.6**			
El Paso [3]	3,778	82	101	26.09	29.77	−.01	73.5	+2.0	98	26	88	49	1	60	38	49	25	22	T	−.3	0	8.8	w.	22	e.	6	26	2	3	1.8	.0	.0	1
Albuquerque [1]	5,314	5	45	24.67	29.77	.....	64.4	+1.1	93	26	79	36	1	50	38	46	29	31	T	−.6	0	10.6	sw.	40	sw.	22	22	6	3	2.5	.0	.0	3
Phoenix [3]	1,107	39	87	28.66	29.79	+.01	75.2	+.2	106	21	92	48	13	59	42	53	34	30	.00	−.1	0	6.0	e.	20	sw.	1	24	7	0	1.5	.0	.0	0
Tucson [1]	2,555	5	23	27.24	29.80	.....	73.1	.....	103	21	91	45	3	55	46	50	28	23	.00	−.2	0	.....	w.	.....	.....	.....	25	5	1	1.5	.0	.0	0
Yuma	142	9	54	29.66	29.80	+.01	76.3	+.1	110	20	94	50	2	59	45	57	40	35	.00	.0	0	6.7	w.	25	w.	1	29	2	0	.5	.0	.0	0
Independence	3,957	5	26	25.88	29.87	+.03	62.8	−.2	91	20	77	35	12	48	38	43	22	...	.00	−.2	0	.....	.....	.....	.....	.....	18	13	0	.....	.0	.0	0
Middle Plateau							**53.5**	**−2.2**										**51**	**1.10**	**+0.1**										**5.1**			
Reno [2]	4,527	61	76	25.42	29.95	+.04	51.8	−2.4	86	20	64	29	2	39	39	41	30	53	.30	−.3	6	7.7	w.	29	w.	3	13	14	4	4.3	T	.0	0
Tonopah	6,090	9	20	23.98	29.87	.....	51.8	.....	81	21	64	24	12	39	36	39	25	...	.01	.....	1	.....	nw.	.....	.....	.....	.....	.....	.....	.....	.1	0	0
Winnemucca	4,339	5	56	25.58	29.93	+.02	50.8	−3.1	88	21	64	28	5	37	42	42	33	58	1.82	+.9	12	8.3	sw.	39	w.	9	3	15	13	6.6	2.8	.0	2
Modena	5,473	10	46	.....	.....	.....	51.2	−2.3	84	21	69	22	3	34	46	.....	.....	...	.06	−.7	3	11.5	sw.	43	s.	28	13	11	7	4.4	.0	.0	1
Salt Lake City [1]	4,227	86	47	25.53	29.88	+.02	53.2	−2.5	86	25	65	34	2	41	38	44	35	57	3.16	+1.4	12	9.6	se.	43	nw.	15	9	9	13	5.9	T	.0	3
Grand Junction	4,602	60	68	25.28	29.82	−.01	60.4	−.7	90	26	74	34	13	47	34	45	29	37	.15	−.7	2	8.0	n.	29	sw.	11	13	13	5	4.2	T	.0	1
Northern Plateau							**54.6**	**−1.9**										**66**	**2.86**	**+1.6**										**7.8**			
Baker [2]	3,471	36	54	26.40	29.97	+.01	48.6	−3.1	81	21	60	25	11	38	36	43	39	75	3.61	+2.1	22	6.0	n.	26	sw.	21	4	5	22	7.6	1.8	.0	6
Boise [1]	2,739	5	49	27.10	29.93	−.01	53.0	.....	90	21	64	30	11	42	36	46	39	67	4.00	.....	16	10.4	nw.	47	s.	22	3	10	18	7.4	.0	.0	5
Pocatello [1]	4,478	5	31	25.40	29.91	+.02	49.4	.....	84	22	61	29	6	38	41	42	36	66	2.29	.....	18	10.2	sw.	36	sw.	25	2	9	20	7.8	.9	.0	2
Spokane [1]	1,929	27	42	27.92	29.95	−.01	53.0	−2.5	83	21	64	32	16	42	35	46	41	68	3.19	+1.8	17	6.8	s.	26	nw.	14	3	6	22	7.8	T	.0	5
Walla Walla	991	57	65	28.90	29.95	−.01	58.2	−1.4	88	21	68	36	11	48	31	...	...	...	3.56	+2.0	15	6.0	s.	21	sw.	26	2	6	23	8.0	.0	.0	3
Yakima	1,076	58	67	28.81	29.96	.....	58.4	−.6	85	21	69	35	2	48	32	48	39	54	1.09	+.5	14	6.5	nw.	20	sw.	22	1	8	22	8.2	.0	.0	3
North Pacific Coast Region							**55.2**	**+1.6**										**75**	**2.46**	**+0.1**										**8.1**			
North Head	211	5	56	29.81	30.03	.00	53.4	+2.5	66	6	58	43	11	48	16	50	47	83	2.74	−.2	18	10.9	nw.	35	s.	24	0	7	24	8.3	.0	.0	0
Seattle [2]	125	90	321	29.88	30.02	+.01	56.6	+2.1	77	6	64	41	11	50	26	50	44	69	1.68	−.2	16	8.0	s.	26	sw.	26	2	10	19	7.8	.0	.0	0
Tacoma	194	172	201	29.82	30.02	.00	55.6	+1.5	78	6	63	37	11	48	30	...	...	...	1.55	−.6	14	7.7	sw.	26	sw.	6	2	6	23	8.4	.0	.0	0
Tatoosh Island	991	9	61	29.93	30.03	+.02	51.9	+2.3	67	21	56	42	11	48	16	49	46	82	1.61	−2.4	18	9.5	w.	32	e.	6	0	4	27	8.6	.0	.0	0
Medford [1]	1,329	29	58	28.60	30.01	.....	55.9	.....	89	20	67	34	1	45	45	48	43	71	3.69	+2.5	18	.....	nw.	.....	.....	.....	1	12	18	7.7	.0	.0	2
Portland, Oreg [2]	154	68	106	29.85	30.02	−.01	57.4	+.5	81	20	65	40	11	49	32	51	47	76	2.59	+.4	18	4.9	nw.	15	sw.	14	2	8	21	7.9	.0	.0	1
Roseburg	510	45	76	29.49	30.04	+.01	56.6	+.6	90	20	66	35	1	47	37	50	45	71	3.38	+1.4	14	3.8	nw.	20	sw.	25	0	11	20	8.1	.0	.0	2
Middle Pacific Coast Region							**58.2**	**−1.5**										**70**	**2.48**	**+1.2**										**5.9**			
Eureka	60	72	88	30.02	30.10	+.05	53.1	+1.1	72	20	58	38	1	48	20	50	47	82	5.43	+3.6	13	7.9	n.	25	n.	4	3	7	21	7.4	.0	.0	0
Redding [1]	722	20	34	29.20	29.97	.....	61.1	−5.3	95	20	72	37	10	50	32	51	42	56	2.32	+.8	11	7.6	nw.	26	w.	3	6	9	16	6.6	.0	.0	4
Sacramento [2]	66	92	115	29.91	29.98	+.04	61.6	−1.7	91	20	74	42	1	49	33	53	47	66	1.07	+.3	5	7.7	sw.	21	sw.	11	16	10	5	4.3	.0	.0	0
San Francisco	155	112	132	29.86	30.03	+.04	56.8	.0	88	20	62	47	11	51	25	51	47	74	1.11	+.3	7	10.5	w.	31	w.	29	7	14	10	5.3	.0	.0	0
South Pacific Coast Region							**64.1**	**−0.6**										**63**	**0.13**	**−0.3**										**4.0**			
Fresno [1]	327	5	35	29.62	29.97	+.05	65.4	−1.8	102	21	80	41	2	51	39	54	43	52	.27	−.2	4	8.9	nw.	27	nw.	27	17	9	5	3.5	.0	.0	0
Los Angeles	338	223	250	29.60	29.96	+.01	62.8	+.6	99	20	72	48	12	54	35	54	48	64	T	−.4	0	6.8	w.	12	w.	12	16	10	5	4.0	.0	.0	0
San Diego [1]	87	20	55	29.88	29.97	+.02	63.3	.....	87	20	71	51	2	56	28	57	53	72	.11	−.2	2	7.5	w.	18	w.	12	14	10	7	4.4	.0	.0	0
West Indies																																	
San Juan, P. R.	82	10	54	29.86	29.94	.....	79.6	+1.0	91	12	84	73	3	73	16	.....	.....	...	4.06	−1.2	13	9.6	e.	27	e.	3	0	22	9	6.6	.0	.0	7
Panama Canal																																	
Balboa Heights	118	6	92	.....	[3]29.82	.00	81.2	+.5	92	6	87	73	10	75	17	.....	.....	[3]88	12.16	+4.1	18	4.7	nw.	23	nw.	7	0	16	15	7.5	.0	.0	8
Cristobal	36	6	97	.....	[3]29.82	−.01	82.4	+1.7	90	27	88	75	1	77	14	77	76	[3]84	8.95	−3.5	24	6.4	se.	24	nw.	5	0	6	25	8.4	.0	.0	3
Alaska																																	
Anchorage	135	36	47	[4]29.80	[4]29.96	.....	50.8	+5.6	72	17	60	31	2	42	28	46	41	69	.25	−0.2	7	5.2	nw.	18	sw.	22	7	7	17	6.6	.0	.0	0
Barrow	25	4	27	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Bethel	22	5	32	[4]29.84	[4]29.88	.....	42.5	+2.1	66	15	52	19	7	33	34	40	35	72	1.58	+.8	12	.....	n.	.....	.....	.....	5	3	23	7.5	.3	.0	0
Fairbanks	484	11	87	[4]29.41	[4]29.92	.....	51.9	+4.9	81	12	65	28	1	38	40	44	36	62	.48	−.1	6	5.8	sw.	21	w.	28	5	10	16	6.7	T	.0	0
Juneau	132	96	116	[4]29.88	[4]29.98	.....	53.3	+5.4	75	11	61	36	2	46	29	47	40	68	1.73	−3.4	13	5.6	w.	20	se.	2	4	2	25	7.9	.0	.0	0
Ketchikan	75	69	85	[4]29.95	[4]29.97	.....	51.9	+3.3	78	11	59	35	4	45	31	48	45	80	6.72	−1.9	16	6.7	se.	27	se.	1	3	6	22	8.1	.0	.0	0
McGrath	331	4	31	[4]29.53	[4]29.91	.....	47.2	.....	74	12	58	24	7	36	40	41	36	68	.75	.....	12	.....	se.	28	se.	5	5	7	19	.....	1.3	.0	0
Nome	43	25	51	[4]29.94	[4]29.96	.....	34.4	+.2	58	25	41	9	7	28	23	38	28	77	1.11	+.5	10	7.7	n.	27	s.	4	6	14	11	6.0	4.5	.0	0
Hawaiian Islands																																	
Honolulu	38	86	100	.....	30.00	.....	76.2	+1.4	84	27	81	68	11	71	...	.....	.....	70	.46	−1.3	6	8.4	ne.	27	ne.	7	9	11	11	.....	.0	.0	0

[1] Data are airport records.
[2] Barometric data (adjusted to old city elevation) and hygrometric data from airport; otherwise city office records.
[3] Observations taken hihourly.
[4] Pressure not reduced to a mean of 24 hours.
[5] Barometric data from airport; other data from city office records.
[6] Wind, clear, partly cloudy, and cloudy data from city office records; other data from airport.

NOTE.—Except as indicated by notes 1, 2, 5, and 6, data in table are city office records.

SEVERE LOCAL STORMS, MAY 1942

[Compiled by Mary O. Souder]

[The table herewith contains such data as has been received concerning severe local storms that occurred during the month. A revised list of tornadoes will appear in the United States Meteorological Yearbook]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Duluth, Minn., and vicinity	1	2:30 p. m.	67		$10,000	Thundersquall	Considerable property damage; 1 person injured; path 20 miles long.
Nerva, Green Bay and Milwaukee, Wis.	1	3:30 p. m.			1,400	Wind	Barns, sheds and silos damaged. Part of the roof of the Menomonie Sugar Co. plant at Green Bay torn off. At Milwaukee, 2 boats collided in the harbor entrance due to rough seas, 1 requiring minor damage.
Bainbridge to Roachdale, Ind.	1				3,000	do	Property damaged.
Noble, Pawnee, Osage, Washington, and Nowata Counties, Okla.	2	2:30 p. m., C. S. T.	67-1,760	3	30,000	Tornado, rain and hail.	This storm formed a few miles south of Morrison and traveled northeastward over a zigzag path for about 100 miles. At Pawhuska, in Osage County, practically all homes in 12 blocks were destroyed and in this area alone, 32 persons were injured, while damage to property was estimated at $30,000. Continuous heavy rain accompanied by hail was general after the storm struck Pawhuska. Damage caused by hail, alone, could not be determined. Much of the territory over which the storm passed is grazing and pasture land and crop loss was therefore nominal.
Cushing, 2 miles south to Turley and Sperry, Okla.	2	3:15-6:30 p. m., C. S. T.	100-880	7	65,000	Tornado and hail	Many buildings destroyed, trees uprooted, and power lines down. Many persons injured. Path 55 miles long. Loss from hail not estimated.
Highland, Kans., and vicinity	2	3:30 p. m.	[1] 5		7,500	Heavy hail	Loss to crops, especially oats and wheat; path 14 miles long.
McCloud to Tuskegee, Okla., and vicinity.	2	3:30 p. m., C. S. T.	1,320	16	116,000	Tornado	Many homes and other buildings demolished and much property badly damaged. Several towns including Paden, Boley, Childsville, and Welty felt the disastrous effects of this storm, but greatest loss and destruction and loss of life occurred in the Negro district just north of Childsville where 16 persons died and many were injured. Property damage, $41,000; crop loss, $75,000; length of path 60 miles.
Fredonia, Chanute, Humboldt, La Harpe, Moran and Boicourt, Kans., and vicinities.	2	3:30-5:20 p. m.	2,200-2,640	3	220,000	do	Chief damage to rural property, power lines and a school building; path 88 miles long.
Iola, Colony and Lone Elm, Kans., and vicinities.	2	4 p. m.	440		100,000	do	Many farm residences, barns, and outbuildings destroyed. In the vicinity of Colony and Lone Elm, 9 residences and 24 barns were demolished. Path 15 miles long.
Leavenworth, Kans., west of	2	5 p. m.	[1] 10		4,500	Wind	Loss in crops; damage to property; path 10 miles long.
Osage and Douglas Counties, Kans.	2	7 p. m.	[1] 3		1,000	Heavy hail	Loss to crops; path 15 miles long.
Solomons, Va	4	3:30 p. m.			1,000	Wind, rain and, hail.	Barns and outbuildings destroyed; trees uprooted.
South Dakota, south-central portion.	4-6					Heavy rain and snow.	Some damage especially in Jones and Lyman Counties by flooding in lowlands; streams overflowing and roadbeds weakened by washouts; some power lines down.
Lexington County, S. C	6	3 p. m.			500	Electrical	Lightning struck a school setting part of it on fire.
Cassville and Glen Haven, Wis., vicinity of.	9	do				Hail	Considerable damage reported.
Trego, Tex	9	7 p. m.	[1] 3		60,000	Heavy hail	Chief damage to growing wheat over a path 6 miles long.
Cambridge, Nebr., 4 to 6 miles northeast.	9	11:30 p. m.	[1] 2		15,000	Hail	Loss principally in growing wheat; small damage to buildings.
Haskell, Gray and Ford Counties, Kans.	10	5-7:45 p. m.	67		20,000	Heavy hail	Extended from northwestern part of Haskell County to Dodge City in connection with the tornado that occurred about the same time. Loss in crops; path 50 miles long.
Haskell, Gray, and Ford Counties, Kans.	10	5-8 p. m.	440	0	80,000	Tornado	Originated in north-central Haskell County and ended north of Dodge City. Damage to farm property except in vicinity of Dodge City, where the chapel and dormitory of St. Marys Academy were demolished. A suburban cafe and dairy barn badly damaged. Two persons slightly injured; path 48 miles long.
Lenora, Kans., 4 miles north	10	7:30 p. m.		0	30,000	do	Damage to farm property; path narrow and 4 miles long.
Nemaha County, Kans	10	do	[1] 5		50,000	Heavy hail	Loss in crops; path 10 miles long.
York, Nebr., and vicinity	11	5-6 p. m.	440	0	13,000	Tornado and hail	Church and all buildings on 1 farm destroyed.
Oketo, Kans., vicinity of	11	5:45 p. m.	[1] 2		10,000	Heavy hail	Property damage, $350; loss in crops, $9,650; path 5 miles long.
Sedan, Nebr	11	11-12 p. m.	[1] 2		4,000	do	Loss in small grains and gardens over an area about 4 miles square.
Shiro, Tex	12	1:30 a. m.	[1] 5		18,500	Heavy hail and rain.	Crop loss, $11,000; property damage, $7,500.
Shepherd, Tex	12	4 a. m.	[1] 1	0	25,000	Tornado and hail	Property damaged; loss in livestock.
Venango to Elsie, Nebr	12	4-5:30 p. m.	300 yds., -6 mls.	0	50,000	do	Property damaged; 3 persons injured.
Oconto, Lodi, Berwyn, Westerville, Weissert, and Comstock, Nebr.	12	6-8 p. m.	[1] 2-10	0	70,000		Farm buildings destroyed with $50,000 loss. In the vicinity of Broken Bow hail damage was estimated at $20,000.
Antelope, Pierce, Knox, and Holt Counties, Nebr.	12	8-11 p. m.	440	6	80,000	Tornado	Farm buildings demolished or damaged; several persons injured.
Menno, S. Dak., vicinity of	12	8:30 p. m.			10,000	Heavy hail	Loss in crops, $5,000; property damage, $5,000.
Morton to Albertville, Minn., and vicinities.	13	12:10-2:45 p. m.	100	0	155,700	Tornado, heavy rain, and hail.	Number of houses demolished and much property damage reported; length of path 6 to 27 miles long. A funnel cloud observed.
Polk to St. Croix Counties, Wis.	13	3-4 p. m.	17-33	0	50,000	Torando	2 houses and 12 barns demolished; livestock injured and trees uprooted 2 persons injured, 1 seriously; path 10 to 12 miles long.
Black River Falls, Hatfield Loyal, Wis., and vicinities.	12	3 p. m.	100-167	1	100,000	do	Many homes and business places damaged, several demolished; 1 person seriously injured; path 35 miles long.
Columbia, Mo	13	3:07 p. m.		0		Tornado and hail.	A farmhouse and 2 filling stations demolished; other property damaged.
Antigo, Wis., vicinity of	13	3:45 p. m.		0	15,000	2 tornadoes	1 appeared first in the southern boundary of Langlade County, moved northeastward, passed 2 miles west of the city and ended about 4 miles north. Another tornado came from west of the city and closely followed the latter part of the path of the first, only half a mile separating the paths at 1 place. At least 2 farm residences were damaged and a number of barns and smaller buildings damaged or demolished.
Calamus, Iowa	13	5 p. m.			3,000	Wind, hail, and heavy rain.	Loss of crops washed out by flooding rain, $1,000; property damaged, $2,000.
Dallas, Tex	13	5:30-6:40 p. m.	[1] 2		100,000	Straight-line wind and hail.	Property damaged; crop loss not given.
Ruston, La., and vicinity	14	2 p. m., C. W. T.	400			Hail	Considerable damage cotton, corn, oats, and truck.
Pahokee, Fla	14	7-7:30 p. m.	880			do	Much damage, not estimated.
Canal Point, Fla	14	7:20-7:45p.m.	2,640		5,000	do	Loss in gardens and fruit.
Monticello, Miss., vicinity of	14	5 p. m.				Heavy hail	Much crop loss; chickens and livestock killed.
Kersaw County, S. C	15	P. m.		0	2,000	Tornado	Church demolished and several nearby structures damaged.
Genoa, Nebr	16	5 p. m.	440		500	Hail	Barley, rye, and gardens on several farms damaged.
Bern, Kans., vicinity of	17	11 a. m.	[1] 3		60,000	Heavy hail	Loss principally to crops; path 10 miles long.

[1] Miles instead of yards.

SEVERE LOCAL STORMS, MAY 1942—Continued

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Ringgold to Osceola Counties, Iowa.	17	3 p. m.	[1] 1–4		$30,000	Hail, wind and heavy rain.	Chickens and pigs killed; strawberries and truck damaged; windows broken and roofs damaged. Gardens, clover, alfalfa, small grains and corn damaged by hail and flooding rain; path 35 miles long.
Tishomingo, Okla.	17	4:30 p. m., C. S. T.	[1] 10		45,000	Hail and wind.	Loss in corn, fruit and truck, $30,000; damage to property, $15,000; path 30 miles long.
Navasota, Tex., vicinity of.	18	5 p. m.	[1] 1		50,000	Straight-line wind and hail.	Crop loss, $49,000; property damage, $1,000.
Abilene, Tex.	18	6:35–7 p. m.	[1] 2		15,000	Heavy hail.	Property damaged; crop loss not estimated.
Minnesota, east-central and west-central counties.	18			1	78,500	Heavy rain and flood.	Frequent light to heavy rains during the month resulted in high water in lakes and streams. Highways, roads, and lowlands inundated. A farmer drowned near Ortonville. In the vicinities of Pine City, Ruthledge, Aitkin, and Ortonville, there was considerable washing and flooding of prospective crops.
Finney and Grant Counties, Kans.	19	5:30–6:30 p. m.	[1] 1–4		60,000	Heavy hail.	Path not continuous; loss in crops; path 30 miles long.
Townville and Fair Play, S. C.	20	P. m.			1,000	Hail.	Considerable wheat and oats beaten into the ground and many fields of young crops had to be replanted.
Clay Center, Nebr.	21	3 a. m.	[1] 4		10,000	do.	Small grains and gardens damaged.
Lushton, Nebr.	21	4 p. m.	2,640		10,000	do.	Small grains, gardens, roofs, and windows damaged.
Nuckolls County, Nebr.	21	4–5 p. m.	[1] 3–6		40,000	Hail and wind.	Loss in small grains; trees, small buildings, roofs, and windows damaged.
Hand County, S. Dak.	21	4:20 p. m.			2,500	Heavy rain and hail.	Roads, culverts, and bridges washed out; trees, fields, and gardens damaged; poultry killed.
McLough, Kans., 3 miles southeast.	22	3 p. m.		0		Tornado.	Funnel cloud observed by many persons, but apparently did not extend to the ground.
Monett, Kans.	22	3–4 p. m.	880–1,760		2,000	Heavy hail.	Drifts of hailstones a foot deep along the highway.
Ravalli County, Mont.	22	5:40–6 p. m.	2,640			Rain and hail.	Damage to peas and gardens: fields washed by heavy rain.
Walla, Columbia, and Garfield Counties, Wash.	22	P. m.	[1] 2–10		100,000	do.	The major portion of the damage was caused by floods in valley and gorges due to the high intensity of the rainfall for a short duration. Damage to roads, bridges, buildings, crops, and livestock.
Delaware and Sullivan Counties, N. Y.	22–23					Heavy rain and flood.	Many thousands of dollars' damage as buildings were swept away or collapsed; highways inundated and bridges and railroads washed out. Erosion and flooding caused extensive agricultural loss.
Custer County, Mont.	24	1–1:20 p. m.	2,640		60,000	Heavy hail.	Chickens and lambs killed. No crop loss as vegetation not sufficiently advanced.
Minnesota, extreme southeastern and southwestern counties.	25–31				100,000	Rain and flood.	Heavy to extensive rains washed out highways, roads and bridges, and railroad tracks; many basements and streets flooded; merchandise damaged; creosote block pavements buckled. A number of houses and other buildings partially submerged; lowlands inundated; growing crops damaged considerably; much poultry perished.
Bryant, S. Dak., vicinity of.	27	6:15 p. m.	100	0		Tornado.	A funnel cloud dipped down several times destroying a feed barn, stock pavilion, and farm elevator; uprooted 27 trees and disrupted light and telephone system besides breaking plate glass windows and store fronts; path 200 yards long.
Bixby, Minn., and vicinity.	29	12:27 a. m.			15,000	Thundersqualls.	Barn and railroad coal shed demolished; some buildings moved from their foundations or otherwise damaged. Chimneys toppled, automobiles and farm machinery damaged; trees uprooted, poles and wires down; path several miles long.
Clark and Hamlin Counties, S. Dak.	29	6 a. m.				Wind, rain, and hail.	Storm cut a 10-mile swath across these counties damaging many buildings, washing out railroad tracks and cutting off communication.
Big Stone, Lac Qui Parle, and Yellow Medicine Counties, Minn.	29	7 a. m.–9 p. m.			28,100	Thundersqualls.	Number of barns; outbuildings, and windmills demolished; many farm buildings damaged; trees uprooted.
Silverton, Tex., vicinity of.	29	6 p. m.	[1] 1	0	10,000	Tornado and heavy hail.	Buildings on one farm completely destroyed; number of other farm buildings damaged and stock killed.
Minneapolis, St. Paul, Minn., and vicinity.	29	6:30–7:45 p. m.			5,000	Thunderstorm and hail.	Considerable damages in places to gardens and property.
Big Stone, Lac Qui Parle, and Yellow Medicine Counties, Minn.	29	9 p. m.	[1] 20		26,900	Hail.	Much damage in places to growing crops and property. Much poultry and some livestock perished. Some fields of flax practically ruined and small grains damaged.
Silverton, Tex., vicinity of.	29	do.	[1] 1	0		Tornado.	House and several barns wrecked; other damage reported.
Del Norte, Colo.	29	11:59 p. m.			100,000	Wind and dust.	Chief damage to plate glass windows.
Michigan, Muskegon and Ottawa Counties—east-southeastward across the lower peninsula.	29	P. m.	[1] 30–50	9	500,000	Thundersqualls.	Throughout the entire belt trees and utility poles were down and roads were blocked in many sections. Most extensive damage in the vicinity of Howell where 4 persons were killed, 75 barns blown down, houses and buildings damaged, and orchard and shade trees uprooted or broken off with estimated damage at from $325,000 to $350,000. Scattered local damage in other parts of the State.
Claude, Tex.	30	4:40–6 p. m.	[1] 3		6,000	Straight-line wind and hail.	Loss to crops.
Lyon, Oscola, and Dickinson Counties, Iowa to Jackson County, Minn.	30	5–6: 30 p. m.	880	0	60,000	Tornado and hail.	The disturbance developed southeast of Little Rock and west of Sibley at about 5 p. m., causing damage to buildings on 1 farm. About 6 p. m., the storm developed at a point 20 miles to the east near Harris and proceeded to move very slowly east-northeastward passing near Lake Park and crossing into Jackson County, Minn. Serious damage occurred on 8 farms in Iowa and 3 in Minnesota. The path was about 12 to 14 miles long. It is reported that 3 funnel clouds were observed at one time.
Windsor, Colo.	30	6 p. m.	[1] 10		30,000	Hail.	Loss in crops.
Jackson County, Minn.	30	6:30 p. m.		0	15,000	Tornado.	Serious damage on 3 farms.
Ness, Trego, and Ellis Counties, Kans.	30	7 p. m.	[1] 3–8		200,000	Heavy hail.	Storm extended from near Utica to eastern part of Ellis though the path was not continuous. Chief loss to wheat. Property damage occurred at the Fort Hays Experiment Farm; path 55 miles long.
Sterling, Colo.	30	8:15 p. m.	[1] 15		600,000	Hail.	Loss to crops; property damaged.
Sauk Centre, Minn., and vicinity.	30	10:30 p. m.	[1] 4		77,000	Thunderstorm and hail.	Extensive damage in places to property and growing crops; much poultry and some livestock perished.
Chambersburg, Pa., vicinity of.	30	P. m.			3,000	Electrical.	Barn with contents burned.
Morris, Minn., and vicinity.	31	12:30 a. m.	880		2,000	Hail and thunderstorm.	Much damage to growing crops; path 2,640 yards long.
Guymon, Okla.	31	2:40–4:18 p. m.	1,320	0	75,000	Tornado and hail.	Property damaged at the Oklahoma Electric and Water Plant disabling the plant. 2.54 inches of rain fell in 20 minutes. Many residences destroyed and buildings damaged; crop loss $75,000.
Delphos and Le Mar, Kans., and vicinities.	31	4:30 p. m.	200	0	50,000	Tornado.	Many farm buildings totally destroyed; path 8 miles long.
Grant County, Kans.	31	5 p. m.	[1] 4		15,000	Heavy hail.	Extended from southwest to northeast across the county. Loss to wheat; path 25 miles long.
Ottawa and Clay Counties, Kans.	31	6–9 p.m.	880	0	6,000	Tornado and hail.	From 50 to 100 percent of wheat damaged; path 4 miles long.
Riley, Kans.	31	7 p. m.			25,000	Wind.	Chief damage in Manhattan where many trees and power lines were blown down with some damage to buildings and automobiles; path 4 miles long.
Perry and Cumberland Counties, Pa.	31	P. m.			100,000	Wind, hail, electrical.	Grain lodged; houses unroofed; silos blown over and buildings moved on their foundations. Trees and utility poles down. Property damage, $65,000; crop loss, $35,000.

[1] Miles instead of yards.

SOLAR RADIATION AND SUNSPOT DATA FOR MAY 1942

[Solar Radiation Investigations Section, L. F. HAND in charge]

SOLAR RADIATION OBSERVATIONS

Explanations of the tables, and references to descriptions of instruments, stations and methods of observation, and to summaries of data, are given in the January 1942 REVIEW, p. 20.

Beginning with this issue, total solar and sky radiation data from Put-in-Bay, Ohio, regularly will appear in table 2 through a cooperative arrangement between this Bureau and Dr. Thomas H. Langlois, Director of the Franz Theodore Stone Biological Laboratory, and Prof. David C. Chandler of the same institution who has immediate supervision of the pyrheliometric equipment. The coordinates of the laboratory are as follows: latitude 41°39′51″N. longitude 82°49′30″W. altitude 618 feet (188.4 meters).

Put-in-Bay is on an island about 5 miles wide and 10 miles long in Lake Erie, 20 miles north of Sandusky, Ohio. Ohio State University is making intensive biological studies of the vegetable and animal organisms in this, the shallowest of the Great Lakes. This university finds that solar radiation which penetrates through the water is of great significance in this study.

TABLE 1—*Solar radiation intensites during May 1942.*

[Gram-calories per minute per square centimeter of normal surface]

MADISON, WIS.

Date	Sun's zenith distance										
	7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p.m.
	75th mer. time	Air mass									Local mean solar time
		A. M.					P. M.				
	e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e.
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
May 7	5.56										5.79
May 8	6.27	0.64	0.75	0.88	1.06	1.24					6.50
May 16	5.56	.84	1.01	1.11	1.33	1.55					7.29
May 19	6.50										6.76
Means		(.74)	(.88)	(1.00)	(1.20)	(1.40)					
Departures		(+.13)	(+.10)	(+.03)	(+.09)	(+.03)					

LINCOLN, NEBR.

May 7	4.57						1.19				6.50
May 8	6.27					1.40	.94	0.79	0.66	0.54	8.81
May 9	8.18						.97				11.38
May 15	4.95					1.41	1.10	.92	.77	.67	6.02

TABLE 1—*Solar radiation intensites during May 1942*—Continued

[Gram-calories per square centimeter of normal surface]

LINCOLN, NEBR.—Continued

Date	Sun's zenith distance										
	7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p. m.
	75th mer. time	Air mass									Local mean solar time
		A. M.					P. M.				
	e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e.
May 30	17.37					1.28	.94	.73	.58	.45	16.79
Means						1.36	1.03	.81	.67	.55	
Departures						−.02	−.10	−.09	−.13	−.11	

ALBUQUERQUE, N. MEX.

	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
May 2	3.45						1.34	1.17	1.05	0.94	3.15
May 3	4.17	1.03	1.12	1.22	1.36	1.57	1.36	1.23	1.11	1.01	3.81
May 4	3.99	1.03	1.12	1.21	1.39						4.37
May 5	3.00	.86	.98	1.12	1.28		1.30	1.16	1.07	.96	2.49
May 6	3.45					1.42	1.11				3.99
May 7	4.57					1.41	1.17	.95	.82	.68	4.75
May 8	5.56	.73	.86	1.00	1.18	1.48	1.17	.97	.83		5.56
May 9	4.17	.89	.98	1.10	1.26	1.45					4.17
May 10	4.17	.78	.90	1.03	1.22	1.46	1.20				4.75
May 11	2.87	.90	1.01	1.17	1.28	1.50	1.26				3.30
May 12	3.63	.86	.97	1.10	1.26	1.49					4.17
May 13	2.06	.92	1.01	1.12	1.29	1.47					2.74
May 14	3.63	.86	.96	1.11	1.28	1.48	1.30	1.16	1.04	.94	3.15
May 15	3.45	.92	1.03	1.13	1.27						3.99
May 16	3.45	.86	.94	1.07	1.24	1.42	1.18	1.07	.92	.81	4.75
May 17	2.74	.85	.96	1.11	1.28	1.52	1.31				3.45
May 19	4.57			1.06	1.22	1.45					3.45
May 20	6.50	.56	.64	.78	.93	1.25	1.02	.89	.73	.65	6.02
May 21	7.57	.57	.67	.84	1.05	1.35	1.06				9.47
May 24	6.50	.83	.90		1.18	1.49	1.27	1.10			7.29
May 26	3.99	.89	.98	1.15	1.32						4.37
May 27	3.30	.89	.99	1.14	1.30	1.53	1.34	1.22	1.10	1.00	4.95
May 28	4.17	.98	1.06	1.17	1.28	1.51					5.36
May 29	3.81				1.34	1.49	1.30	1.23	1.03	.94	5.16
May 30	3.45	1.00	1.08	1.17	1.34	1.55	1.30	1.14	1.04	.99	4.95
May 31	3.15	1.02	1.10	1.18	1.35	1.53	1.32	1.16	1.06	.98	3.63
Means		.87	.96	1.09	1.26	1.47	1.24	1.12	.98	.90	

BLUE HILL, MASS.

May 1	7.1					1.26					6.3
May 2	8.0	0.45	0.57	0.68		1.13					6.3
May 5	7.7	.60	.68	.90		1.25	0.98	0.88	0.77	0.69	6.9
May 6	7.4				1.05	1.23					6.3
May 8	9.0									.27	9.7
May 10	11.3							.86	.79	.68	7.7
May 11	5.8	.77	.86	.99	1.15	1.28	1.04	.89	.70	.60	6.3
May 12	9.4	.47	.56	.69							7.7
May 29	11.7					1.06	.58	.41	.28		14.1
May 30	18.2	.17	.25	.35							18.2
Means		.49	.58	.72	1.10	1.20	.87	.76	.64	.56	
Departures		−.16	−.24	−.28	−.01	−.16	−.21	−.12	−.11	−.10	

*Extrapolated.

TABLE 2.—*Daily totals and weekly means of solar radiation (direct+diffuse) received on a horizontal surface*

[Gram-calories per square centimeter]

Date	Washington	Madison	Lincoln	Chicago	New York	Fresno	Fairbanks	Cambridge	Nashville	Twin Falls	New Orleans	Riverside	Blue Hill	Friday Harbor	Ithaca	Newport	State College	Put-in-Bay	San Juan u. v. below 3132 Å
	cal.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*milli-cal.*
Apr. 30	546	514	226	546	535	371	.....	582	504	576	256	671	590	206	597	555	588	542	332
May 1	577	340	217	389	421	550	.....	532	483	269	642	468	538	559	493	565	519	427	303
May 2	465	380	65	634	378	696	.....	614	571	668	534	698	616	542	318	655	429	591	414
May 3	565	218	340	310	403	681	.....	475	414	332	390	667	473	598	343	520	454	314	155
May 4	325	368	280	303	297	723	.....	367	316	189	423	663	403	617	445	381	444	254	363
May 5	680	182	63	444	653	689	.....	672	692	677	120	634	684	574	310	703	738	640	149
May 6	491	30	158	178	463	691	.....	614	360	669	548	457	622	595	253	637	341	176	138
Mean	521	290	193	401	450	628	472	551	477	483	416	608	561	527	394	574	502	420	287
Departure	+45	−152	−264	−6	−5	+11	+60	+118	.....	−39	+14	+81	+82	+1	−14	+83	−34	.....	.....
May 7	263	630	635	260	80	680	.....	56	334	548	208	498	58	514	246	71	360	62	412
May 8	431	676	618	618	351	666	.....	254	350	616	316	663	328	376	186	461	115	636	319
May 9	521	330	596	184	62	709	.....	309	642	447	692	620	279	520	624	356	598	618	132
May 10	383	685	187	537	634	644	.....	460	459	470	618	406	450	228	740	486	775	746	357
May 11	652	53	373	222	684	589	.....	663	567	285	707	550	710	221	700	743	719	268	193
May 12	556	199	549	259	535	684	.....	347	583	307	122	686	337	362	233	320	459	380	245
May 13	624	433	600	521	594	715	.....	536	602	512	300	669	472	210	486	592	650	621	323
Mean	494	429	508	372	420	670	503	375	505	455	423	584	376	347	459	432	525	476	286
Departure	+30	−25	+54	−57	−26	+32	+42	−54	.....	−121	−14	+40	−107	−185	−4	−69	+29	.....	.....
May 14	462	208	625	650	610	349	.....	125	346	405	378	665	309	492	655	494	585	348	392
May 15	542	68	692	48	507	551	.....	408	324	204	489	653	306	726	442	490	308	56	301
May 16	79	623	519	600	175	723	.....	456	698	724	731	637	487	673	235	451	307	125	198
May 17	625	430	534	530	457	725	.....	205	726	742	691	671	242	560	229	262	458	547	288
May 18	655	348	696	366	682	720	.....	103	277	519	549	649	127	696	640	254	761	265	.....
May 19	354	685	244	579	234	685	.....	309	465	678	529	629	314	306	238	510	350	667	66
May 20	317	343	580	368	349	678	.....	313	74	681	669	634	311	637	68	452	94	105	262
Mean	433	386	556	449	431	633	449	274	416	565	577	648	312	584	358	416	409	302	275
Departure	−43	−90	+43	+8	−38	−19	+2	−136	.....	−43	+127	+124	−195	+47	−108	−78	−63	.....	.....
May 21	417	414	224	609	184	701	.....	98	536	684	.....	559	109	423	121	312	113	659	345
May 22	245	723	278	657	323	734	.....	170	506	433	734	488	181	543	208	245	188	152	417
May 23	578	544	496	548	267	695	.....	240	431	316	593	611	214	415	446	411	464	574	443
May 24	.....	630	706	641	540	625	.....	429	547	481	286	456	370	486	414	529	543	265	298
May 25	540	664	337	601	525	412	.....	524	610	323	478	560	460	324	324	590	202	650	450
May 26	622	253	621	144	656	763	.....	525	286	370	713	656	514	722	666	692	587	466	402
May 27	448	411	549	425	508	744	.....	481	619	418	619	665	461	521	317	435	444	621	370
Mean	475	520	459	518	429	668	547	352	505	432	570	571	330	491	357	459	363	484	394
Departure	−25	+21	−83	+41	−48	+6	+89	−35	.....	−193	+133	+32	−133	−88	−143	−28	−95	.....	.....
May 28	632	258	634	481	670	648	.....	636	550	624	682	683	671	485	796	672	751	632	370
May 29	624	460	668	697	578	750	.....	650	557	377	281	653	645	573	596	701	699	524	117
May 30	568	558	599	713	521	724	.....	520	658	689	533	643	502	338	439	606	440	513	340
May 31	506	198	315	511	494	730	.....	445	646	697	637	676	393	353	500	474	597	428	326
June 1	132	212	513	578	107	717	.....	592	642	672	613	625	609	626	152	517	100	572	76
June 2	194	358	495	464	135	742	.....	243	515	548	666	562	254	650	239	177	164	388	140
June 3	317	514	625	388	227	733	.....	82	590	544	195	526	107	342	332	136	449	606	62
Mean	425	365	550	547	390	721	559	452	594	593	515	624	454	481	436	469	457	523	222
Departure	−83	−126	+30	+63	−117	+43	+86	+23	.....	−1	+47	+78	−85	−69	−55	−59	−23	.....	.....
	−532	−2,604	−1,540	+343	−1,638	+511	+1,953	−588	.....	−2,779	+2,149	+2,485	−3,066	−2,058	−2,268	−1,057	−1,302	.....	.....
ACCUMULATED DEPARTURES ON JUNE 3																			
	+2,338	−3,108	−3,899	+3,101	−105	+371	+1,092	−679	.....	−1,890	+8,078	+5,803	−3,948	−196	−1,365	−1,554	.....	.....	.....

POSITIONS, AREAS, AND COUNTS OF SUN SPOTS FOR MAY 1942

Communicated by Capt. J. F. Hellweg, U. S. N. (Ret.), Superintendent, U. S. Naval Observatory.] All measurements and spot counts were made at the Naval Observatory from plates taken at the observatories indicated. Difference in longitude is measured from the central meridian, positive toward the west. Latitude is positive toward the north. Areas are corrected for foreshortening and expressed in millionths of Sun's hemisphere. For each day, under longitude, latitude, area of spot or group, and spot count, are included assumed longitude of center of the disk, assumed latitude of center of the disk, total area of spots and groups, and total spot count.

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1942	h m		°	°	°	°				
May 1	11 27	7429	−57	43	−9	57	242	1	F	U. S. Naval.
		(*)	−17	83	−6	17	24	2		
		7428	+12	112	+14	22	48	3		
		7423	+16	116	+9	21	48	5		
		7423	+20	120	+9	23	12	4		
		7430	+34	134	−22	36	12	1		
		7426	+73	173	−13	73	24	1		
				(100)	(−4)		410	17		
2	10 8	7429	−43	45	−9	43	134	1	F	Do.
		7423	+30	118	+9	32	97	12		
				(88)	(−4)		290	13		

POSITIONS, AREAS, AND COUNTS OF SUN SPOTS FOR MAY 1942—Continued

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1942	h m		°	°	°	°				
3	8 50	7429	−30	45	−10	31	145	1	VG	Mt. Wilson.
		7423	+44	119	+8	46	170	18		
				(75)	(−4)		315	19		
4	11 13	7429	−16	45	−10	17	97	4	G	U. S. Naval.
		7423	+58	119	+8	60	291	17		
				(61)	(−4)		388	21		
5	10 40	7429	−11	37	−12	13	12	2	F	Do.
		7429	−4	44	−10	6	97	7		
		7423	+70	118	+8	71	48	4		
		7423	+76	124	+8	77	291	3		
				(48)	(−4)		448	16		
6	10 33	(*)	+3	38	−13	10	12	5	G	Do.
		7429	+9	44	−10	11	73	7		
				(35)	(−4)		85	12		

POSITIONS, AREAS, AND COUNTS OF SUN SPOTS FOR MAY 1942—Continued

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1942	h m		°	°	°	°				
7	11 10	7433	−79	302	+14	79	242	1	G	U. S. Naval.
		7432	−70	311	+12	71	97	1		
		7431	−3	18	+6	10	24	3		
		7429	+19	40	−13	21	24	7		
		7429	+22	43	−10	23	48	6		
				(21)	(−4)		435	18		
8	10 35	7433	−65	303	+14	67	242	1	G	Do.
		7432	−57	311	+12	59	97	1		
		7429	+30	38	−13	31	12	4		
				(8)	(−3)		351	6		
9	10 22	7435	−87	268	−4	87	194	1		Do.
		7434	−73	282	+10	73	97	1		
		7433	−51	304	+13	54	194	1		
		7432	−44	311	+12	47	73	1		
				(355)	(−3)		558	4		
11	10 31	7435	−60	269	−5	60	291	5	F	Do.
		7434	−47	282	+10	49	97	1		
		7433	−25	304	+13	30	194	1		
		7432	−17	312	+12	23	24	4		
				(329)	(−3)		606	11		
12	10 46	7435	−47	268	−5	47	291	7	VG	Do.
		7434	−34	281	+10	36	97	1		
		7433	−11	304	+13	20	145	1		
		7432	−3	312	+12	17	24	2		
				(315)	(−3)		557	11		
13	10 14	7435	−33	269	−5	33	291	7	G	Do.
		7437	−23	279	+14	29	6	2		
		7434	−21	281	+9	25	97	1		
		7436	−19	283	−7	20	12	2		
		7433	+2	304	+13	17	97	1		
		7432	+11	313	+12	19	24	3		
				(302)	(−3)		527	16		
14	12 17	7435	−19	269	−5	21	291	13	G	Do.
		7437	−9	279	+15	20	12	2		
		7434	−7	281	+8	13	97	1		
		7433	+16	304	+13	23	97	1		
		7432	+25	313	+10	28	12	3		
				(288)	(−3)		509	20		
15	11 27	7438	−40	235	+9	41	12	1	VG	Do.
		7435	−6	269	−5	6	291	14		
		7434	+4	279	+5	9	24	4		
		7434	+7	282	+8	12	73	1		
		7433	+28	303	+13	33	97	7		
				(275)	(−3)		497	27		
16	8 19	7439	−79	195	+14	79	97	1	G	Mt. Wilson.
		7435	+7	271	−5	7	242	9		
		7434	+18	282	+9	22	73	1		
		7433	+41	305	+13	44	48	1		
				(264)	(−3)		460	12		
17	11 7	7439	−70	179	+14	71	24	4	G	U. S. Naval.
		7439	−63	186	+13	65	145	1		
		7435	+22	271	−5	22	194	1		
		7434	+32	281	+9	34	73	1		
				(240)	(−2)		436	7		
18	10 26	7439	−58	178	+14	60	24	3	F	Do.
		7439	−50	186	+14	52	97	1		
		(*)	−8	228	−8	11	12	2		
		7435	+31	267	−5	31	12	1		
		7435	+36	272	−5	36	194	1		
		7434	+45	281	+9	47	48	1		
				(236)	(−2)		387	9		
19	10 36	7439	−37	186	+14	40	97	1	G	Do.
		7435	+51	274	−5	51	145	7		
		7434	+59	282	+9	60	48	1		
				(223)	(−2)		290	9		
20	10 57	7439	−24	185	+14	29	97	1	VG	Mt. Wilson.
		7441	−9	200	−13	15	12	2		
		7440	+7	216	+13	17	12	2		
		7435	+65	274	−5	65	97	10		
		7434	+70	279	+9	70	24	1		
				(209)	(−2)		242	16		

POSITIONS, AREAS, AND COUNTS OF SUN SPOTS FOR MAY 1942—Continued

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1942	h m		°	°	°	°				
21	11 7	(*)	−18	178	−12	21	12	3	G	Mt. Wilson.
		7439	−11	185	+14	20	97	1		
		(*)	+18	214	−11	22	6	1		
		(*)	+32	228	−8	33	12	2		
		7435	+80	276	−5	80	48	1		
				(196)	(−2)		175	8		
22	14 11	7439	+4	185	+14	18	73	1	VG	U. S. Naval.
		(*)	+8	189	+11	16	12	3		
				(181)	(−2)		85	4		
23	10 17	7439	+15	185	+14	22	73	1	G	Do.
				(170)	(−2)		73	1		
24	11 7	7439	+28	184	+14	33	73	3	F	Do.
				(156)	(−2)		73	3		
25	11 23	7439	+43	186	+15	47	48	1	G	Do.
				(143)	(−1)		48	1		
26	10 50	7439	+55	185	+14	57	24	1	G	Do.
				(130)	(−1)		24	1		
27	10 38	7439	+68	185	+14	70	24	1	G	Do.
				(117)	(−1)		24	1		
28	8 46	7442	+9	114	−10	12	24	1	VG	Mt. Wilson.
		7439	+80	185	+14	80	12	1		
				(105)	(−1)		36	2		
29	8 40	.....	.....	No spots.			.....	.....	VG	Do.
30	10 57	.....	.....	...do			.....	.....	VG	Do.
31	12 7	7443	+34	97	+8	36	12	3	G	U. S. Naval.
				(63)	(−1)		12	3		

Mean daily area for 30 days = 278.

(*) Not numbered.
VG=very good; G=good; F=fair; P=poor.

PROVISIONAL RELATIVE SUNSPOT NUMBERS FOR APRIL 1942

[Based on observations at Zurich. Data furnished through the courtesy of Prof. W. Brunner, Eidgenössiches Sternwarte, Zurich Switzerland]

April 1942	Relative numbers	April 1942	Relative numbers	April 1942	Relative numbers
1	39	11	*d* 44	21	94
2	35	12	*Ecc* 58	22	*ab* 94
3	41	13	59	23	82
4	*d* 30	14	67	24	85
5	32	15	60	25	*a* 59
6	17	16	*ab* 69	26	*Ec* 79
7	*Ec* 26	17	*a* 71	27	*EMcc* 89
8	----------	18	*Ecc* 84	28	73
9	*b* 87	19	*Mcd* 109	29	*d* ...
10	34	20	105	30	*a* 61

Mean, 28 days = 61.9

a=Passage of an average-sized group through the central meridian.
b=Passage of a large group through the central meridian.
c=New formation of a group developing into a middle-sized or large center of activity: E, on the eastern part of the sun's disk; W, on the western part; M, in the central-circle zone.
d=Entrance of a large or average-sized center of activity on the east limb.

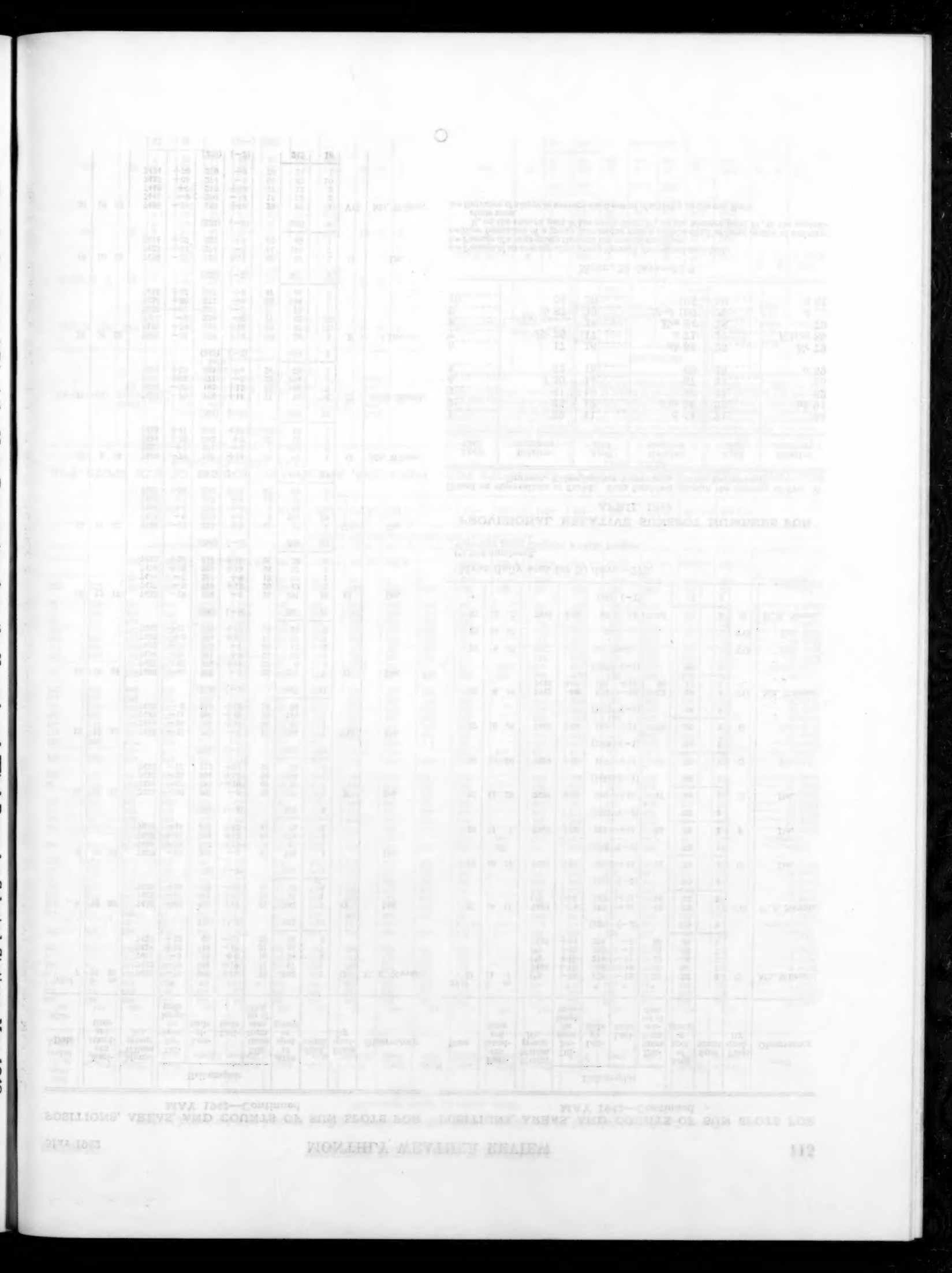
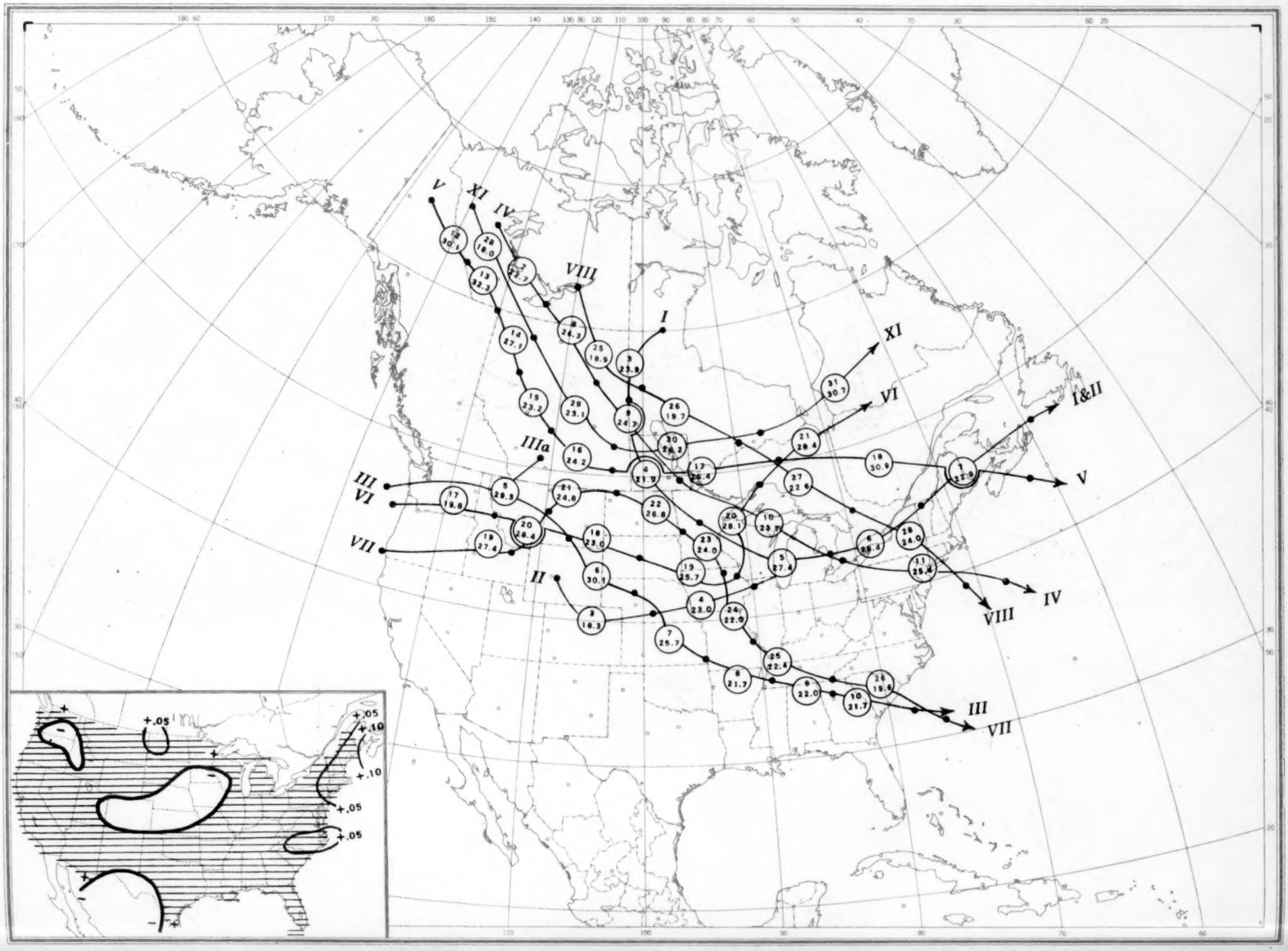


Chart I. Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, May 1942

HOURLY PERCENTAGES
100 50 50 100
Shaded portions show excess (+)
Unshaded portions show deficiency (−)
Lines show amount of excess or deficiency

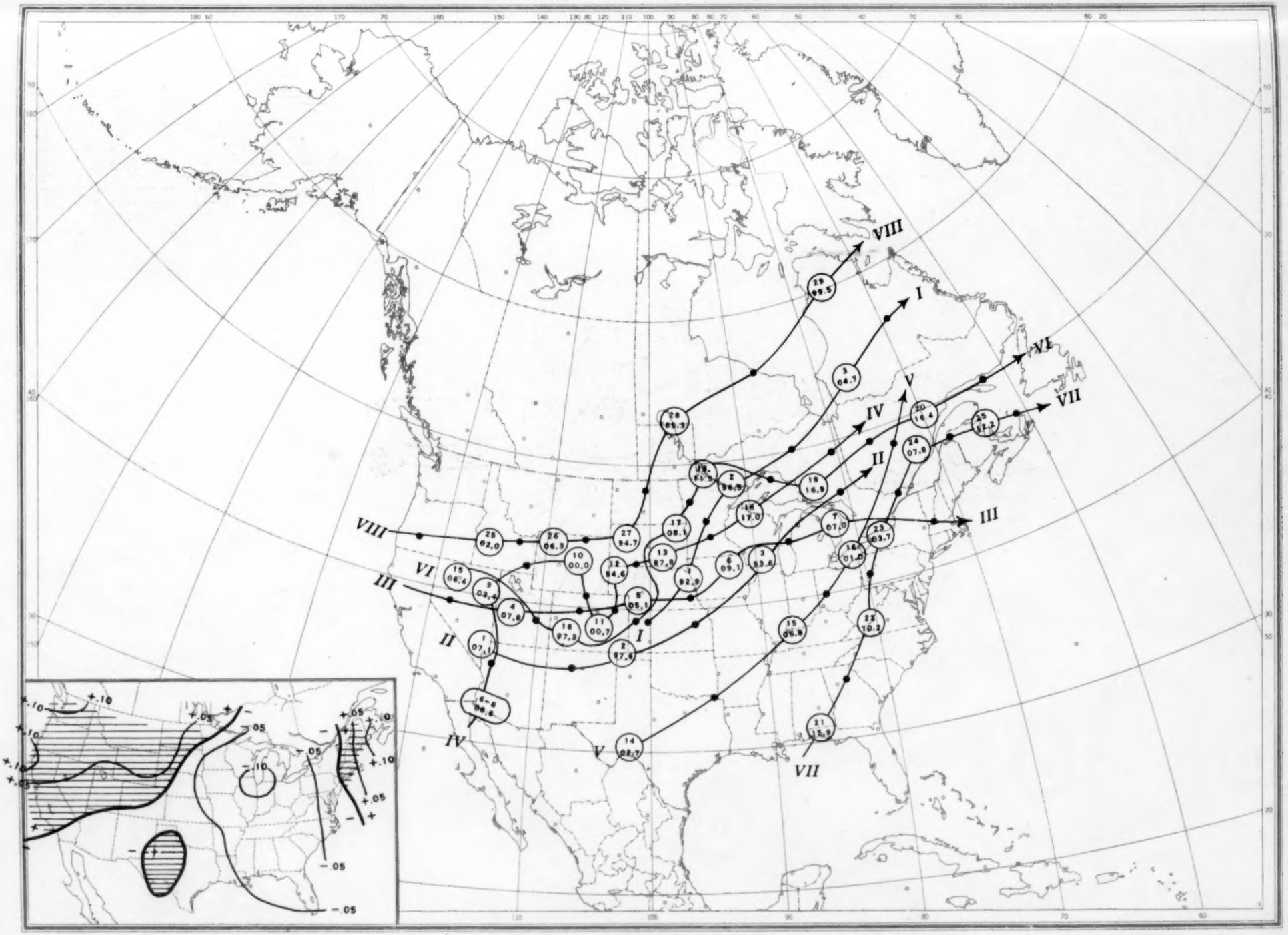
Chart II. Tracks of Centers of Anticyclones, May 1942. (Inset) Departure of Monthly Mean Pressure from Normal



Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 7:30 p. m. (75th meridian time).

Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 7:30 p. m. (75th meridian time).

Chart III. Tracks of Centers of Cyclones, May 1942. (Inset) Change in Mean Pressure from Preceding Month



Circle indicates position of cyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of cyclone at 7:30 p. m. (75th meridian time).

Chart IV. Percentage of Clear Sky Between Sunrise and Sunset, May 1942

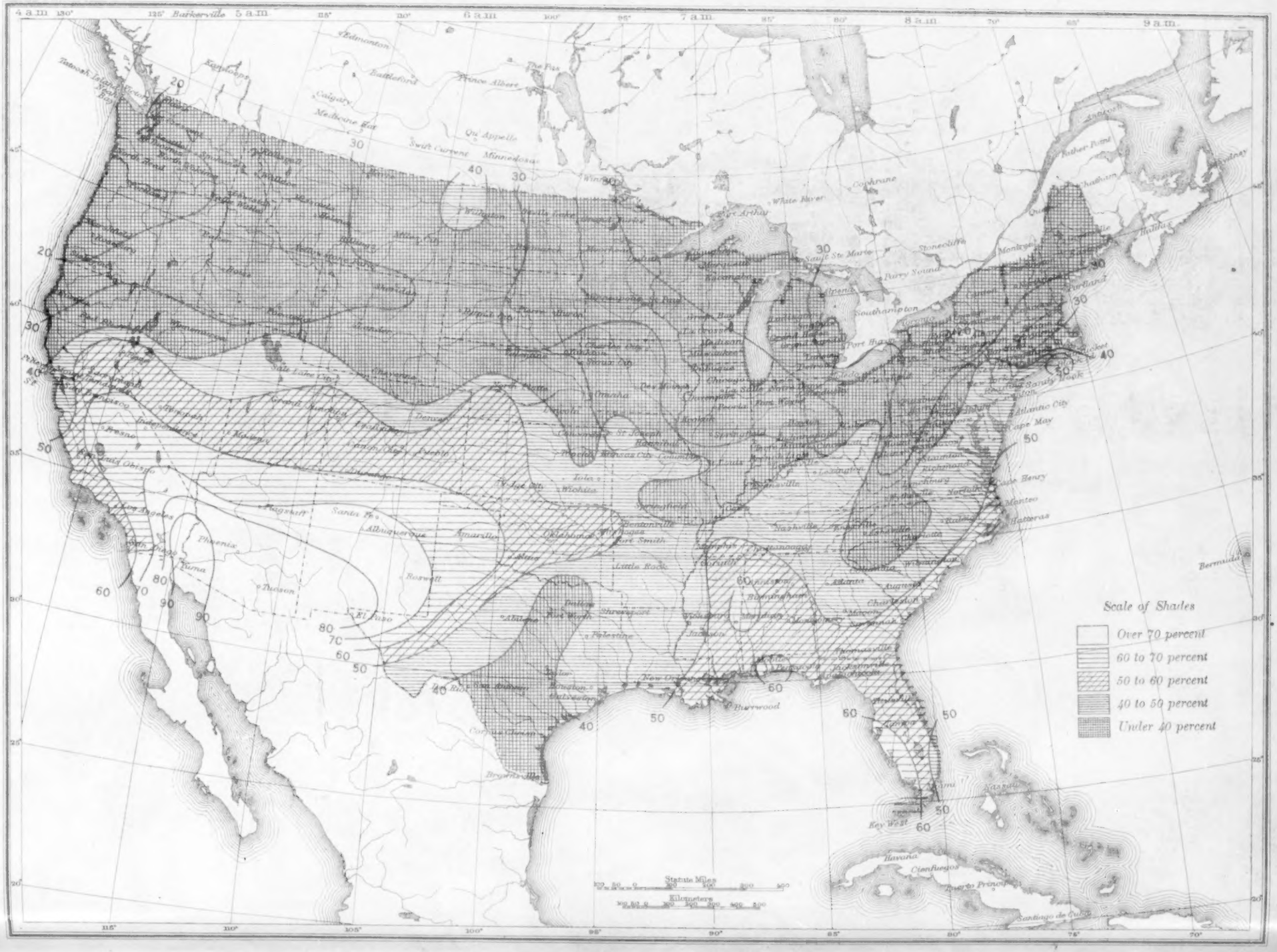


Chart V. Total Precipitation, Inches, May 1942.

Chart V. Total Precipitation, Inches, May 1942.

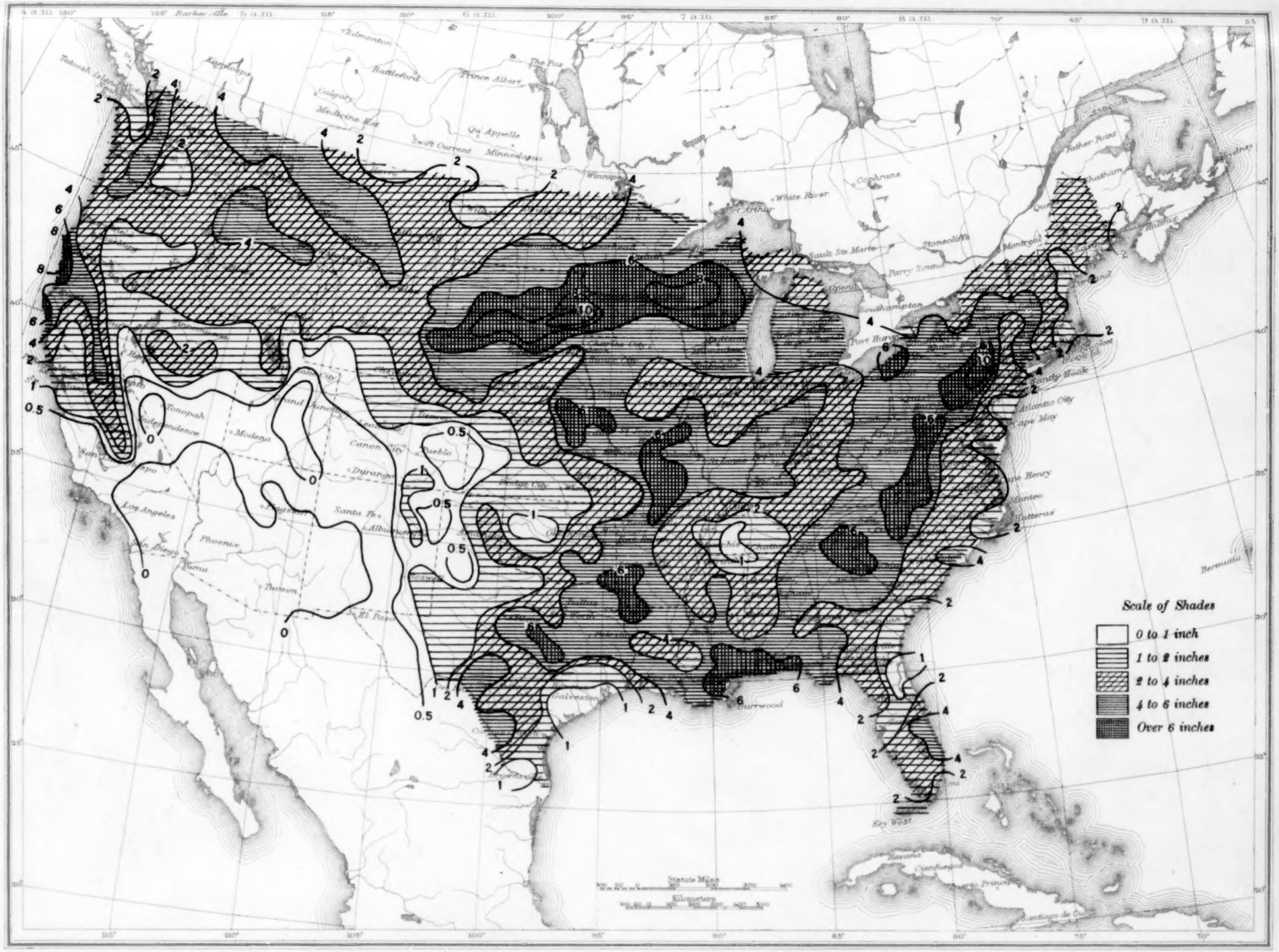


Chart VI. Isobars at Sea Level and Isotherms at Surface; Prevailing Winds, May 1942

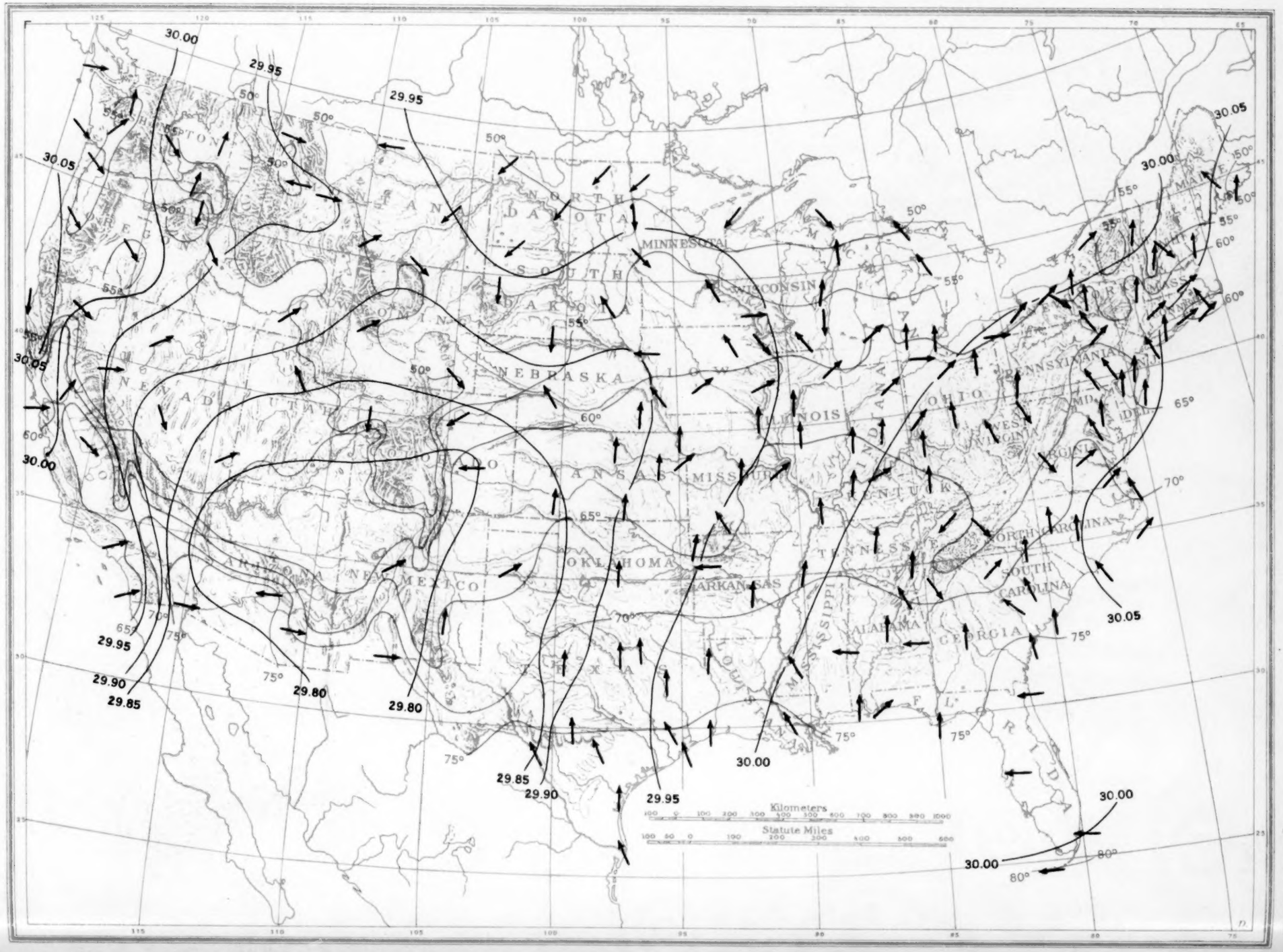


Chart VIII. Isobars (mb) for 1,524 Meters (5,000 ft.) and Isotherms (°C.) and Resultant Winds for 1,500 Meters (m. s. l.) May 1942

Chart VIII. Isobars (mb) for 1,524 Meters (5,000 ft.) and Isotherms (°C.) and Resultant Winds for 1,500 Meters (m. s. l.) May 1942

Isobars and isotherms based on radiosonde observations at 11:00 p. m. (E. S. T.) and winds based on pilot-balloon observations at 5:00 a. m. (E. S. T.).

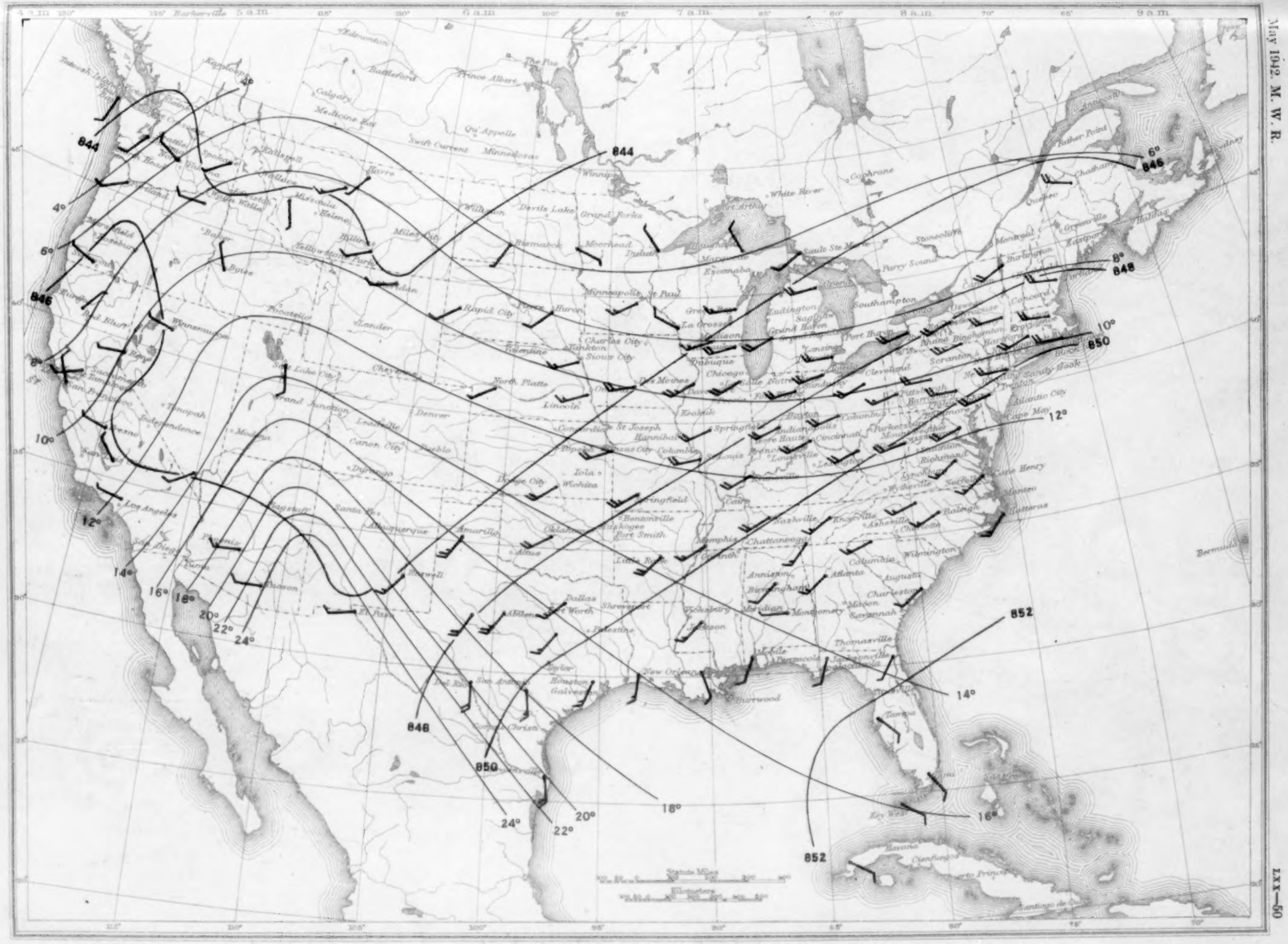


Chart IX. Isobars (mb) Isotherms (°C.) 11:00 p.m. (E.S.T) and Resultant Winds 5:00 a.m. (E.S.T.) for 3,000 Meters (m.s.l.) May 1942

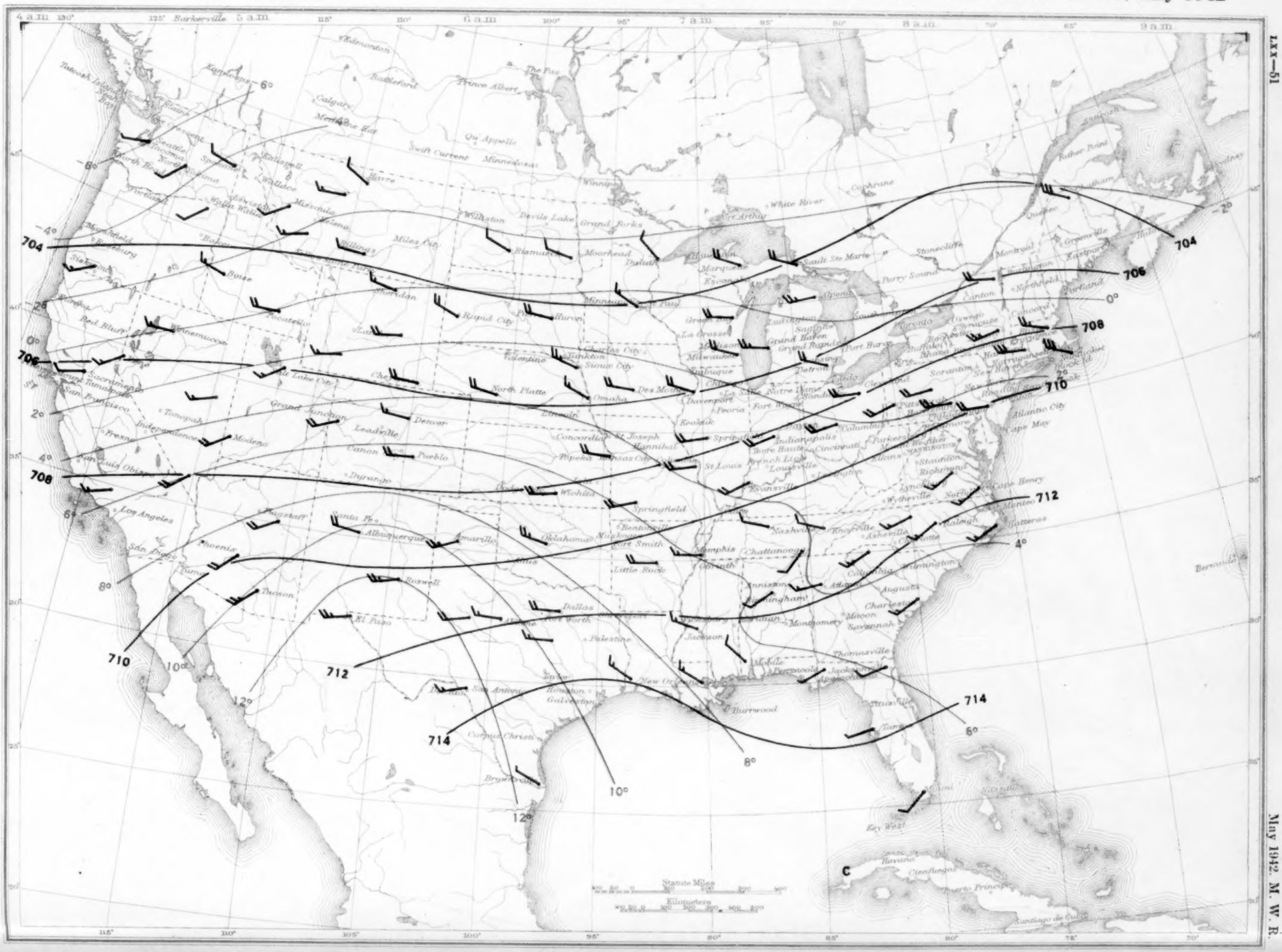


Chart X. Isobars (mb) Isotherms (°C.) 11:00 p.m. (E.S.T.) and Resultant Winds 5:00 p.m. (E.S.T.) for 5,000 Meters (m.s.l.) May 1942

Chart X. Isobars (mb) Isotherms (°C.) 11:00 p.m. (E.S.T.) and Resultant Winds 5:00 p.m. (E.S.T.) for 5,000 Meters (m.s.l.) May 1942

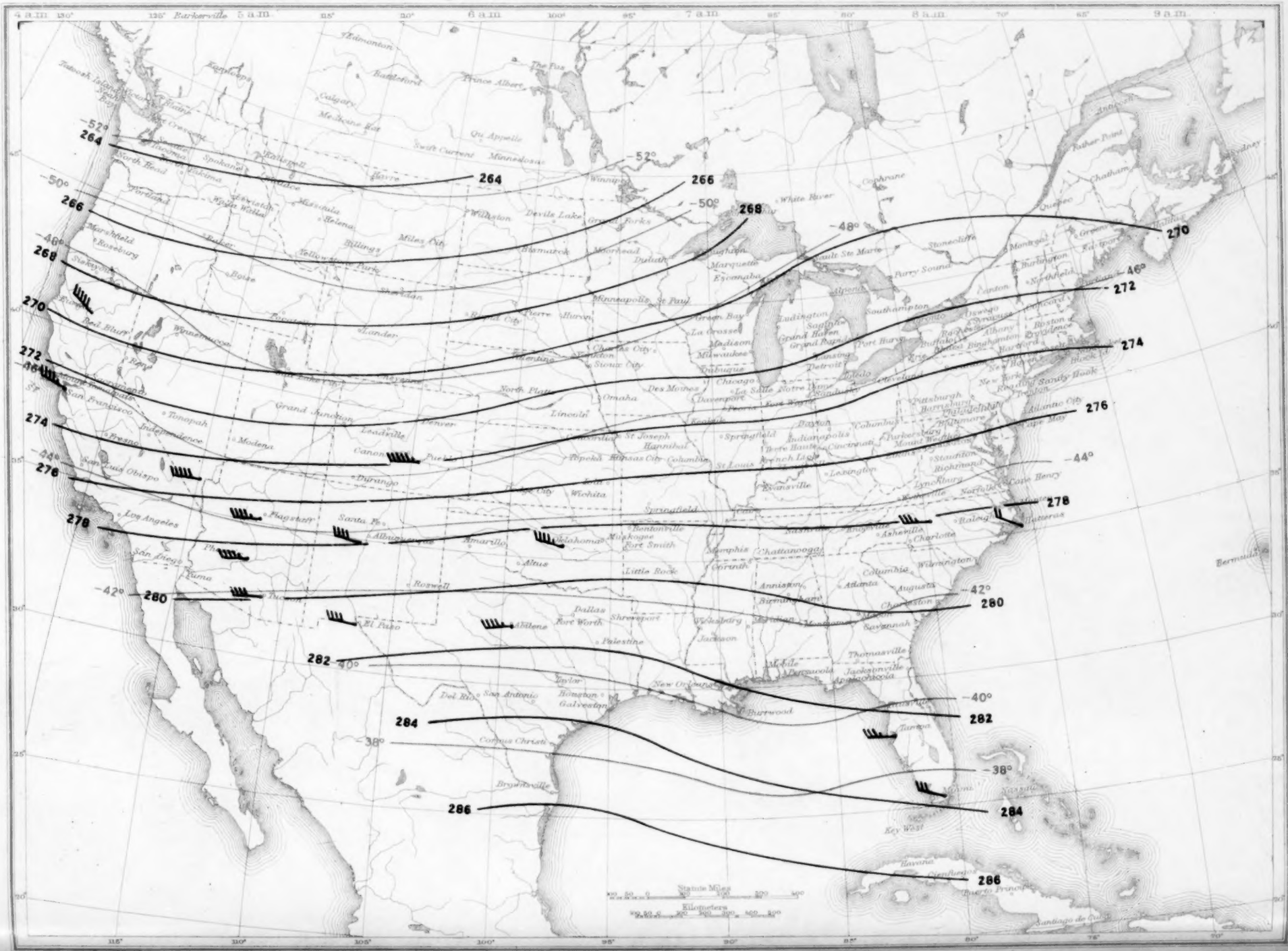



Chart XI. Isobars (mb) Isotherms (°C.) 11:00 p.m. (E.S.T.) and Resultant Winds 5:00 p.m. (E.S.T.) for 10,000 Meters (m.s.l.) May 1942